met finishing

PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, METAL SPRAYING and all METAL FINISHING PROCESSES

Vol. 5 No. 53 (New Series) MAY, 1959

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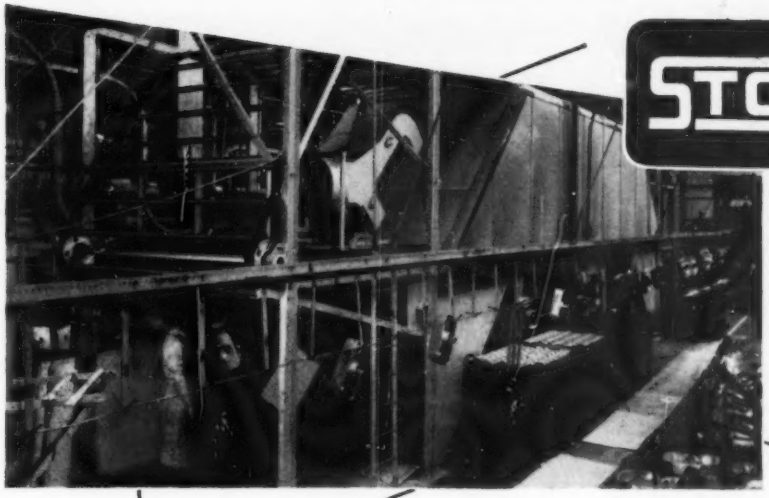

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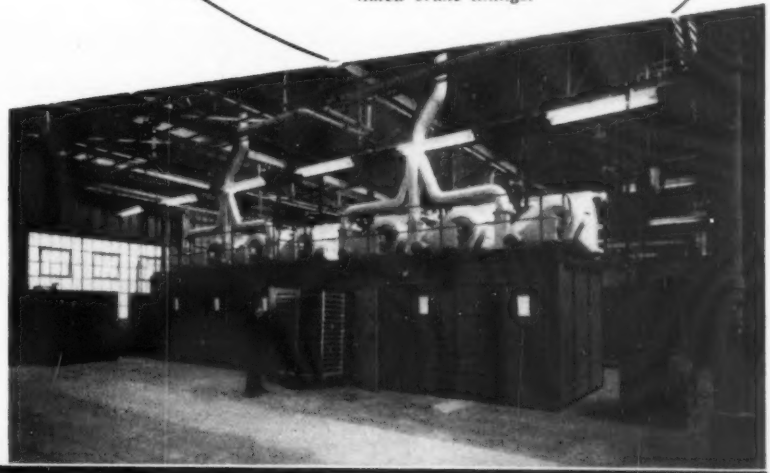

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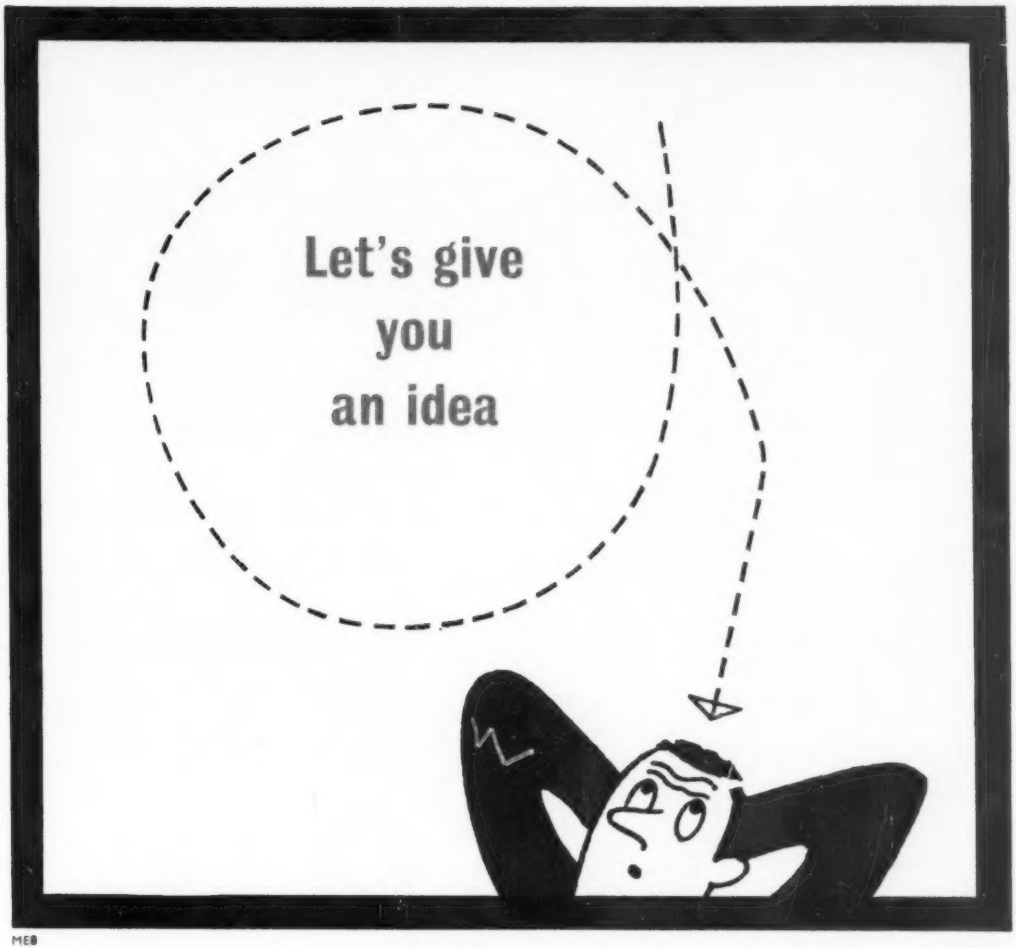

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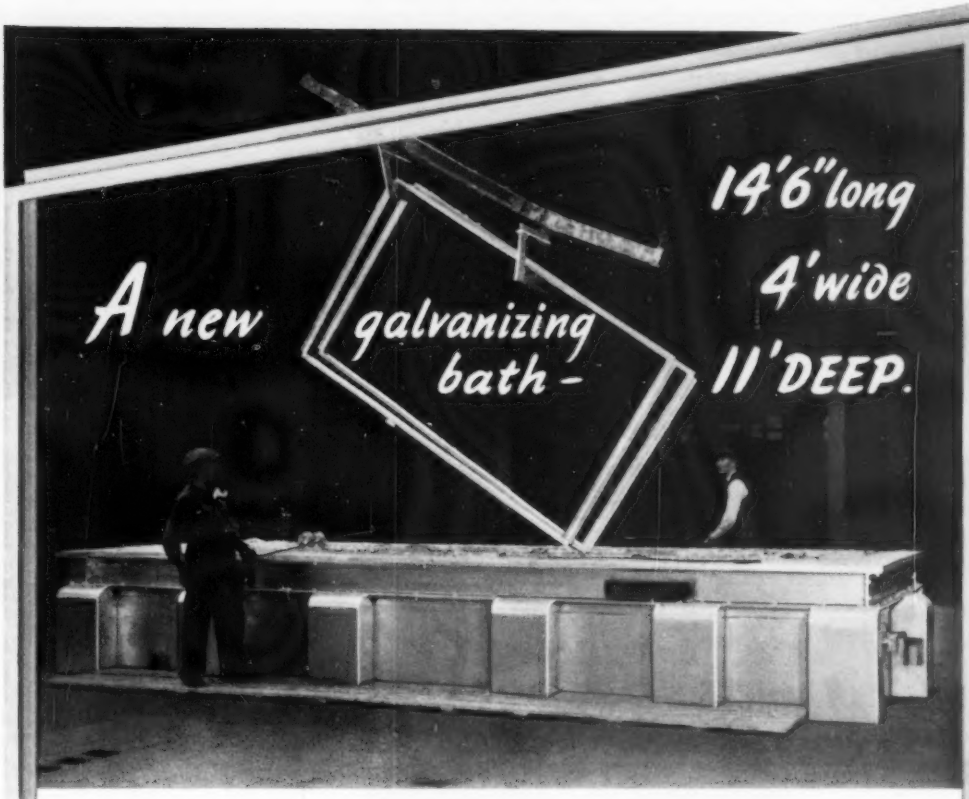

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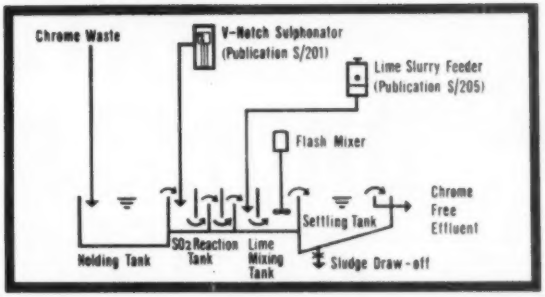

Typical Treatment Flow Diagram

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metal finishing Journal

May, 1959 Vol. 5, No. 53 (New Series)

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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

Contents

EMBARRASSMENT OF RICHES

THERE are many people living among us today who can well remember the Diamond Jubilee of Queen Victoria, and who therefore have witnessed during their lifetime advances in the extent to which mankind can control and harness the natural properties of materials for his benefit which have far exceeded the visions of even the most uninhibited prophets of the nineteenth century. When that long-lived monarch acceded to the throne, Kensington was a rural suburb where Cobbett had only shortly before ceased to operate his market garden, lying as it did as yet outside the scope of the advancing Wen.

Scarcely more than three generations ago to travel from London to Brighton was a major enterprise and to cross beyond the sea almost a feat of daring. Of all the changes that the past half century has witnessed it is the opening up and speeding of communications between man and his fellow which is destined surely to play the most significant part in determining the trend and direction of the progress of civilisation.

While Drake took over two years to circumnavigate the globe, some three hundred years of progress and technical development were needed to enable Phileas Fogg to bring the record down to 80 days. A bare century later the journey can now be effected in as many hours.

While man is winging his way through the skies at the speed of sound his words can travel before him at the speed of light so that this morning's deeds can become this afternoon's history. The spoken word and the written word pour forth, seeking and giving information on every aspect and facet of human enterprise.

The need to canalize and control this vast torrent of information has brought into being new industries and new organizations which have had perforce to devise their own techniques of communication. Thus a structure of technical Institutions and trade Associations has arisen, disseminating information, usually to a restricted body of specialists, on subjects considered to be of concern to them. Other publications have multiplied simultaneously, covering in some instances ever narrowing fields, and in others ever wider ones. The amount of information now being issued is of such volume that it is largely impossible for any individual to assimilate even that part of it which relates directly to his activities, and so there have come into being yet further organizations whose function it is to condense this vast bulk into more readily assimilable form. The appearance of the first issue of Metal Finishing Abstracts published by one of our contemporaries, is the latest manifestation of this trend to appear in the field covered by Metal Finishing Journal. The list of publications abstracted and the abundance of the abstracts themselves bear witness to the magnitude of the task of keeping informed even in this somewhat restricted and specialized field.

Furthermore on June 15 in Detroit, U.S.A. begins the Fifth International Conference on Electrodeposition and Metal Finishing at which some fifty or more papers will be presented and discussed, many of them in simultaneous sessions. Although modern technical advances have made it possible to reach Detroit within only a few hours of leaving London, it is still so far impossible for a delegate to attend more than one meeting at a time.

While it is undoubtedly vital that technical information of this nature should be made available it is perhaps reasonable to pause and consider in what way the most effective use can be made of this embarrassment of technical riches.

Talking Points

by "PLATELAYER"

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

WHY DO THEY DO IT ?

A PERENNIAL mystery to the motorist is the reason why car designers do some of the things they do ; and they never explain. Currently quite a number of cars are using stainless steel for body trim instead of chromium plate. The reason for this, one assumes, is that stainless steel is more durable and less likely to corrode than plated ware. Admittedly, however, the metal is somewhat dull in comparison with chromium and this lack of lustre increases with time and cannot be readily restored by polishing, but the appeal of a rustless finish is understandable.

The curious thing, however, is that stainless steel trim is largely being used above the "waistline" of the car, *i.e.* for door frames, window surrounds and the like, and yet it is on the upper part of the vehicle that the corrosive conditions are least severe, and the inferior brightness of the metal is most obvious to the eye ! If the two types of trim are to be used simultaneously, one might therefore logically expect the lower bright parts to be in stainless steel, such as body strips, radiator grilles, hub caps and lamp surrounds rather than the less vulnerable and more prominent upper fittings, but there does not seem to be much logic in these matters.

The progress of stainless steel, however, will depend on whether the motorist (or more likely, his wife) will prefer relatively dull-looking stainless trim on a new car to the more brilliant, if perhaps shorter lived, chromium. Experience seems to show, however, that visual appeal is still by far the greatest single factor in selling a car.

ANOTHER CHORE LESS

IT never ceases to surprise most people how the inevitable chores of today can become the intolerable nuisance of tomorrow. Drawing water from the well and trimming and lighting the oil lamps must, in their day, have seemed part of the permanent order of things which have got to be done, like getting dressed in the morning. Indeed, in many parts of the world this is still the case today, but the thought of engaging in such activities in most parts of our urban civilization would be regarded as a depressing imposition.

So far as motor cars are concerned, polishing and waxing of the paint has always been regarded as the only way of keeping it in reasonable condition. In the case of cellulose finishes this is indeed essential to remove what is euphemistically called "traffic film," but is nothing more nor less than decomposed and broken-down cellulose. Stove enamels do not develop this film to such an extent but still have to be cleaned thoroughly and waxed from time to time if they are to preserve their appearance, as they inevitably lose their gloss. Car manufacturers, in fact, nowadays deliberately produce a lower gloss on stove-enamelled vehicles to minimize imperfections which may appear before the car is sold. It is interesting to see, therefore, that General Motors have this year introduced acrylic lacquers for the first time on many cars ; it is claimed that these retain their gloss at least three times as long as previous materials. Most important of all, however, is the fact that they wash free from dirt more readily and are less easily stained by oil and road tars. Whether the acrylics have disadvantages to compensate for these advantages remains to be seen, particularly from the production point of view.

BRIGHTER SKIES

LOOKING at the planes at London Airport one would think that the colour schemes selected for them by the pundits who control airlines were intended to make them as invisible as possible. Greys, off-whites and silver predominate, perhaps because of the military origins of civil aviation, which still adheres to the tradition that aircraft may be heard, but are best not seen.

It has at last begun to dawn on the authorities that with increasing traffic density inconspicuousness in the air is a real danger, and experiments are being started on painting aeroplanes in bright or fluorescent colours to reduce collision hazards. Under the conditions prevailing in high altitude flights some problems are likely to arise in finding adequately durable paints, while the weight of the paint layer itself is not inconsiderable. It is not inconceivable that we may yet see aircraft with their fuselages and wings anodized and dyed.

SCIENCE IN THE ABSTRACT

IT is reported that the forthcoming Decennial Index of the Journal of the American Chemical Society is going to run to 19 volumes. This is understandable when it is realized that something like 300,000 abstracts are prepared outside the Soviet Union and some 400,000 inside it per annum. In spite of this, in fact still only about one quarter of the world's engineering and scientific literature is abstracted in any one year.

THE FORMATION OF HARD FILMS ON ZINC AND ZINC ALLOY SURFACES BY ELECTROLYTIC PROCESSES*

by H. FRY, B.Sc.†

(*A Communication from the British Non-Ferrous Metals Research Association*)

Introduction and Summary

THE two-stage process of forming protective films on zinc and zinc alloy developed earlier in this work consisted of anodic oxidation of the metal in an alkaline solution followed by autoclaving in an alkaline silicate solution. A process was sought which would obviate the autoclave treatment and produce a more attractive finish.

The search was at first directed towards reproducing the beneficial effect of autoclaving during which a large proportion of silica is introduced into the film.[1] It seemed possible that silica might be incorporated in the film during anodising if a suitable electrolyte was used. Reports about the H.A.E. films on magnesium[2] indicated that the incorporation of a high proportion of anions did occur under certain conditions.

It was found that a hard film could be produced from the relatively soft anodic film formed in an alkali-carbonate solution by a second anodic treatment in a silicate solution. Details of this procedure are not reported here since it was found subsequently that hard films could also be formed on zinc or zinc alloy in a single d.c. anodizing process. The films so produced were rough, though some variations in roughness could be obtained by variations in electrolyte composition. In a given electrolyte very much smoother films were produced if an a.c. source was used.

The single-stage process was still expensive, mainly because of the relatively large power supply required. Tests show that a minimum current of about 240 mA per sq. cm. was needed to raise the voltage to the required value—about 100V—if small zinc or zinc-alloy specimens were treated. Under these conditions a maximum power output of 12 watt per sq. cm. of treated surface. or 11 kW per sq. ft. was required during a short stage of the process.§ When larger commercial zinc alloy die-castings were treated with the same a.c. process the maximum power requirement was only about one sixth, *i.e.* 2 watt per sq. cm. The resulting finish was unattractive mainly because it was opaque. Attempts to prepare translucent films were unsuccessful; they included the use of higher frequency currents, variations in the electrolyte composition, and electrolytic pretreatment in borate solutions. Efforts to reduce power consumption were successful, the minimum effective current density on small specimens falling from about 240 mA per sq. cm. to about 8 mA per sq. cm. when half-wave rectified d.c. was used instead of a.c.; the change in current form had no appreciable effect on the roughness or appearance.

Commercial zinc-alloy die-castings of slightly complicated shape have been treated with a single-stage electrolytic process to give uniform films resembling those on small samples, but the finish produced was considered to be uneconomical relative to other finishes of comparable properties and more attractive appearance.

The present report summarizes the later stages of the work in order to assist those who may wish to pursue the attempt to develop an acceptable coating.

EXPERIMENTAL

Both high-purity zinc and Mazak 3 alloy were used for small-scale experimental work. Some tests were also carried out on commercial pressure-die-cast door fittings made of Mazak 3.

The flat materials were cut into strips 1 x 6 cm. Zinc samples were electropolished in the earlier part of the work. An area of 1 x 3 cm. on one side of the samples was left exposed and the remainder coated with insulating lacquer. The exposed side faced the second electrode at about 5 cm. distance in a half full beaker which contained a stirrer running at moderate speed.

A nickel cathode was used for anodizing, and a zinc counter-electrode for electrolyses with a.c. The cell voltage was measured on a valve voltmeter and the current with an ammeter in experiments with a.c. and with smooth d.c.; in experiments with other current forms the voltage across the cell and a small series resistor was measured with a calibrated cathode-ray oscilloscope and the current with the same instrument by observing the potential drop across the known series resistor.

*The work described in this paper was made available to members of the B.N.F.M.R.A. in a confidential Research Report issued in December 1958.

†Investigator, B.N.F.M.R.A., London, N.W.1.

§Note that the two electrodes are treated simultaneously in the a.c. process so that the power consumption for each is only a half of the total consumption.

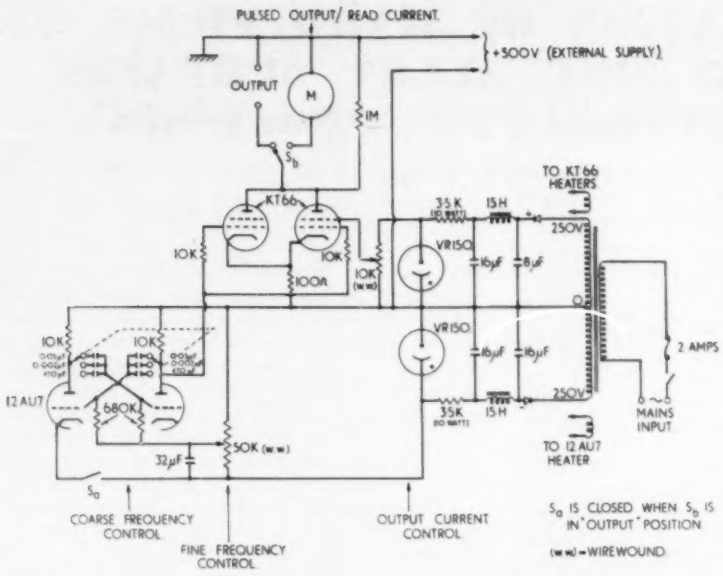


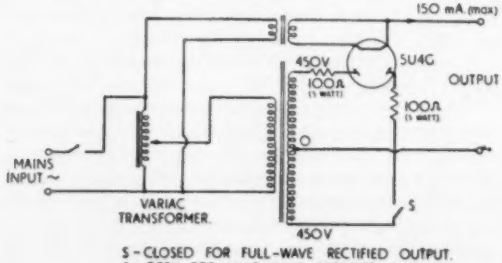
Fig. 1 Current-controlled square wave generator

Diagrams showing the circuits for the apparatus supplying the current are shown in Figs. 1 and 2 and the measuring and electrolysis circuit is shown in Fig. 3. The square-wave current was apparently perfectly square with equal " on " and " off " periods at frequencies up to 5000 c/sec. The maximum voltage of alternate waves of the full wave rectified current differed by about 10 per cent. The ideal potential/time curves of the different wave forms are shown in Fig. 4.

The electrolysis vessel was surrounded with a cooling mixture during experiments in which the electrolyte temperature tended to rise appreciably, treatments being carried out at 16°C. except where it is stated otherwise.

" Analar " materials were used for the preparation of anodising solutions wherever available. Waterglass Q79 (sodium silicate) was of commercial purity, containing 18 per cent Na_2O, 38.3 per cent SiO_2, 43.7 per cent H_2O.

Fig. 2.—Half/full wave rectified current generator



The silicate-borate-tungstate solution used in much of the present work had the following nominal composition: 180 gm. per l. sodium silicate Q79, 90 gm. per l. sodium borate, 73.4 gm. per l. sodium tungstate, and about 30 gm. per l. sodium hydroxide to reach a *p*H of about 11.4. Tungstate and borate were dissolved in hot water and the hot solution added to the solution of sodium silicate and sodium hydroxide.

Testing of Films

The appearance of the films as observed with the unaided eye and with a binocular microscope (x 30) was noted, and in suitable cases film thickness was measured in microsections (x 1000) with an accuracy of about $\pm\frac{1}{4}\mu$. The rough profile of some films was clearly visible in such sections.

The abrasion resistance was measured by a method due to Schuh and Kern,[3] in which a stream of abrasive particles falls on to the film from a fixed height.

The corrosion resistance of a few samples was tested by exposing them to the industrial atmosphere on the roof of the laboratories of the Association.

RESULTS

Single-stage Smooth d.c. Treatment

Methods of Forming Compact Films

Films were prepared under some conditions which were free from holes, coherent, and adherent to the basis metal. They were generally too rough to be of practical value.

When zinc was made the anode in a suitable

electrolyte, the anode voltage rose at constant current as a film formed; visible sparks appeared at the anode when the voltage drop there had reached about 100V, the exact voltage depending on the composition of the electrolyte and the current density; the sparks appeared to wander over the surface of the anode but had a strong tendency to concentrate at the edges where the film often became thick and excessively rough. The voltage continued to rise more or less slowly. Sparking was accompanied by a characteristic but unidentified smell.

Films on which sparking had occurred invariably contained some glassy globules; when electrolysis was discontinued before sparking had begun, the films produced at the anode were smooth but rather grey and no glassy globules were seen. The films were thin and their abrasion resistance was low. The abrasion resistance of a number of the rougher and apparently thicker films was also low: in these instances it was clear from the mark left by the abrasive that the films had spalled and had not been abraded. The films were relatively easily detached from the basis metal by bending.

Films of the type described above were obtained from solutions containing silicate and borate in different proportions and from silicate solutions containing borate, phosphate or carbonate ions, but not from silicate solutions by themselves. Films with very high abrasion resistances—about 20,000 ml. abrasive—were obtained from a solution of 200 gm. per l. Q79 waterglass, 90 gm. per l. sodium borate, 15 gm. per l. sodium tungstate ($Na_2WO_4.2H_2O$) and 20 gm. per l. sodium hydroxide at *p*H 11.3. In this solution, with an initial current density of 25 mA per sq. cm., sparking started at 100 V, the current was then allowed to fall to 6 mA per sq. cm. and the voltage rose to 200 V.

A reasonably even coating was obtained from a solution of 67 gm. per l. Q79 waterglass, 90 gm. per l. sodium borate ($Na_2B_4O_7.10H_2O$), 24 gm. per l. sodium hydroxide at a *p*H of 11.7 using a constant current density of 10 mA per sq. cm.

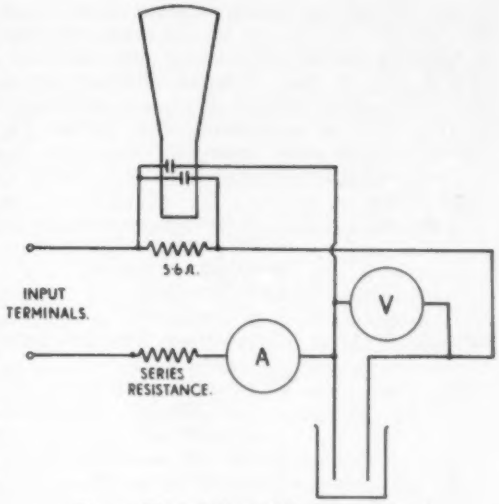


Fig. 3. Electrolytic and Measuring Circuit

The voltage at which sparking over the films started was about 110 V in silicate-borate solutions and slightly lower in the presence of tungstate ions; it fell to 75 V in silicate-phosphate solutions and to 70 V in silicate-carbonate solutions, a particularly bad smell being noticeable during sparking in the solutions containing phosphate.

One test indicated that smoother films are formed when the temperature of electrolysis is raised to 50°C.

Conditions Under which Compact Films were not Observed

A number of tests with negative results were made in sodium-silicate and borate-silicate solutions

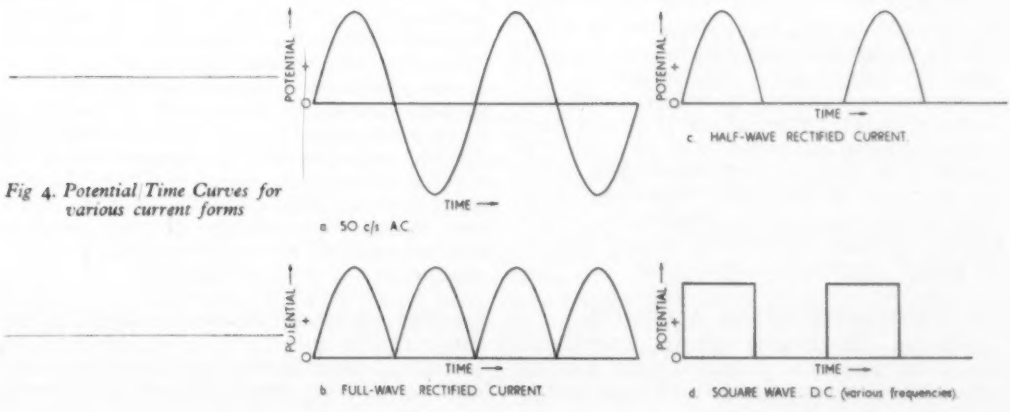


Fig 4. Potential/Time Curves for various current forms

at high *p*H and at current densities below about 250 mA per sq. cm.; in borate-silicate solutions at relatively low *p*H and current densities below 10 mA per sq. cm.; in borate-silicate solutions with silicate above 200 gm. per l.; and in silicate-phosphate solutions at relatively low values of *p*H. Further unsuccessful tests were made in the solutions tested below, most of them at a *p*H of about 10.8.

200 gm. per l. Q79, 0.1N sodium succinate
" " 0.18N sulphuric acid
" " N sodium sulphate
" " 0.4N acetic acid
" " 0.14N boric acid
||200 gm. per l. " N potassium hydrogen tartrate
100 " " 90 gm. per l. sodium borate, 100 gm. per l. potassium manganate
20 " " 18 gm. per l. sodium borate
20 " " potassium manganate
63 " sodium borate, 60 gm. per l. sodium phosphate at *p*H 3 & 7
21 " sodium borate, 20 gm. per l. sodium phosphate at *p*H 3, 7, 9

||Insoluble constituents filtered off after making-up the mixture.

Attempts to Colour Films

Attempts to obtain coloured films were made by anodizing in a basic solution containing 200 gm. per l. Q79, 90 gm. per l. $Na_2B_4O_7.10H_2O$, 74 gm. per l. $Na_2WO_4.2H_2O$, and sufficient NaOH to give a *p*H of about 11.4, to which had been added :—

6 gm. per l. and 54 gm. per l. potassium dichromate
4 gm. per l. and 35 gm. per l. potassium manganate
5.3 gm. per l., 10.6 gm. per l. and 53 gm. per l. copper tartrate.

No even colour was obtained in any of the tests although spots of colour appeared on some films in places where sparking had been most marked.

Unsuccessful attempts were also made to anodize zinc in ammoniacal solutions containing nickel.

The Effect of High Anodic Voltages

In these tests the current was adjusted so as to make the voltage rise as high as possible; this usually involved reducing the current or allowing it to drop when sparking had started and increasing it after sparking had become less frequent. The highest anodic voltages reached were about 420 V, the resistance of the anodic film being about 250,000 ohms per sq. cm. Examination of the samples obtained revealed no improvement in mechanical properties or smoothness.

Alternating-current Treatment

Minimum film forming current. Experiments showed that in a given electrolyte similar films are formed by direct current and by 50 c/s alternating current, but a higher a.c. than d.c. current density is required to form a particular type of film.

Thus, in a solution of 0.146N NaOH, 0.054N Na_2CO_3, smooth white films are formed by d.c. at current densities between 40 and 200 mA per sq. cm^2[1], the voltage rising to at least 110 V within a relatively short period, but a.c. of 450 mA per sq. cm. only produced a slightly milky semi-transparent film the anode potential rising to no more than 17 V. Similarly, when electrolytic treatments were carried out in a solution of 200 gm. per l. Q79 saturated with sodium-phosphate at *p*H 11.6, hard anodic films were formed with d.c. at current densities of 10 and 50 mA per sq. cm. with anodic voltages well above 100 V, while with a.c., films were formed at 150 mA per sq. cm. but not at 10 or 50 mA per sq. cm.

Roughness of films. The sparked films formed by a.c. in a given electrolyte were smoother than any sparked film formed by d.c. in the same electrolyte presumably because the sparks in the former case were smaller, more numerous and more uniformly distributed. Quantitative estimates of roughness were not made.

A film anodized with d.c. to a maximum voltage of 150 V in a solution of 21 gm. per l. $Na_2B_4O_7.10H_2O$, 20 gm. per l. $Na_3PO_4.12H_2O$ at 50 mA per sq. cm. for 10 minutes was very rough and uneven, and flaked off the basis metal, whereas a film formed under the same conditions but with a.c. for a period of 36 minutes to a maximum voltage of 260 V was grey, hard and acceptably smooth.

In exploratory tests using solutions of 200 gm. per l. Q79, 90 gm per l. $Na_2B_4O_7.10H_2O$, 18 gm. per l. $Na_2WO_4.2H_2O$, and NaOH to give various *p*H values, with or without 6 gm. per l. $K_2Cr_2O_7$, very considerable variations of roughness were observed. The indications were that the degree of roughness is most strongly dependent on the composition of the electrolyte, on its temperature—roughness increasing with the temperature, and on the *p*H of the solution—roughness increasing as the *p*H decreases. The degree of roughness was less affected by variations in the current density, even during sparking, and in the duration of the treatment. Some smooth and even films were obtained in the solution at *p*H 11.4 containing 6 gm. per l. $K_2Cr_2O_7$; treatment times of 5 to 10 minutes were employed at a current density of 50 mA per sq. cm., giving maximum voltages between 65 and 80 V. Slightly less smooth films were formed on commercial die-castings treated for similar periods in the same solution, the maximum voltage being at least 150 V.

Anodising of Commercial Die-Castings by the a.c. Process

About a dozen commercial die-castings—door handles of various shapes and lock plates—were

treated with the a.c. process using the a.c. mains and a fixed resistor in series with the cell. A die-casting was used as one of the electrodes and one or two strips of zinc which had previously been treated with the a.c. process were used as counter-electrodes. A litre beaker contained the solution, consisting of 180 gm. per l. sodium-silicate Q79, 90 gm. per l. sodium-borate, 75 gm. per l. sodium-tungstate and sodium-hydroxide to give a *p*H of about 11.4. The beaker was usually cooled to prevent a rise of temperature above about 20°C.

In a typical example, the surface area of a lockplate was 90 sq. cm. The current density was raised gradually from about 10 mA per sq. cm. to give a rate of voltage rise greater than 1 V per min. The maximum current density on the die-casting was 35 mA per sq. cm. at 52 V. These conditions corresponded to the maximum power input of about 1.7 watts per sq. cm.; the current fell subsequently, and the voltage rose beyond 52 V at a reasonably high rate without further adjustment to the supply. Sparking started in one region at 86 V after 13 minutes, and gradually spread to other regions; the film in any region became lighter in colour after sparking had begun there. The time required to cover a die-casting completely varied between ½ hour and 1 hour. The resulting light grey films were usually fairly smooth and even and had an abrasion resistance between 1000 and 2000 ml. The appearance of polished and unpolished die-castings was identical after treatment.

Die-cast Yale-type locks could not be treated successfully with the a.c. process, loose white material appearing in recesses.

Films were also prepared on a number of door roses and door handles in a borate-silicate-tungstate solution containing potassium dichromate. Apart from some isolated defects the films were even and uniform, whether the casting had been polished before treatment or not.

Attempts at Colouring Films Made by the a.c. Process

A considerable number of tests were carried out using the borate-silicate-tungstate solution. A uniform pale yellow-green film was produced in the treatment when about 6 gm. per l. potassium dichromate was added to the solution, and a green to brown film—depending on the conditions of electrolysis—when potassium ferrocyanide or ferricyanide was added. These films were smooth but had a relatively low abrasion resistance. In tests in which organic dyes were added to the basic solution, the resulting films never had more than a slight trace of colouring. The dyes used were Oxanal Gold RL and Alimax Orange GR at various concentrations up to 0.5 per cent wt./vol. The addition of 13 gm. per l. potassium iodide to the electrolyte had no effect on the colour of the film.

Some Characteristics of Films Prepared by the a.c. Process

Abrasion resistance. The abrasion resistance of some reasonably smooth films formed in the borate-silicate-tungstate solution lay between 3000 and 7000 ml., while the abrasion resistance of some very smooth green-yellow films formed in the same solution with added potassium chromate was less than 200 ml. and that of some similar films on commercial die-castings lay between 200 and 600 ml.

The abrasion resistance of one very smooth sample treated in the borate-silicate-tungstate solution for 10 minutes to reach a maximum cell voltage of 38 V was less than 200 ml., while the abrasion resistance of a rather less smooth sample treated for 30 minutes in the same solution and reaching a maximum cell voltage of 165 V lay between 3000 and 4250 ml.

For comparison, a fresh standard film of anodised aluminium had an abrasion resistance of 8000-9000 ml. although on ageing this decreased to about 3000 ml. The abrasion resistance of a stove-enamelled die-casting was about 20000 ml.

Corrosion resistance. A die-cast door handle and rose coated with the green-yellow films prepared in silicate-borate-tungstate-chromate solution were tested under humid conditions. There were a few white and dark spots on the rose after a testing time of 6 weeks.

Similar samples were placed on the roof of the laboratories of the Association in Euston Street where the atmosphere is highly polluted and corrosive. For comparison a stove-enamelled die-casting supplied by a member of the Association, a bracket of galvanized material treated with the proprietary clear "Anozinc" finish, and two anodised and autoclaved door roses were exposed at the same time. After 2 months' exposure—from September to November 1957—the samples treated with the single stage process had lost practically all their greenish-yellow colour, a number of small dark spots had appeared on the rose and a small portion of the film on the handle flaked during cleaning of the sample for inspection. A number of blisters had appeared on the stove-enamelled specimen, there were dark marks and dull patches on the bracket, and both autoclaved samples showed some white rust before cleaning, one much more than the other.

Thickness. Films anodised in the borate-silicate-tungstate solution at *p*H 10.9 for 6, 30 and 60 minutes at 150 mA per sq. cm. were found to have average thicknesses of 20, 50 and 80μ respectively. All these films were rough, the degree of roughness increasing with the duration of the treatment.

Films formed in the same solution at 50 mA

per sq. cm. for 10, 60 and 90 minutes had average thicknesses of 1, 20 and 30μ. In the formation of the first of these films the voltage had reached only 38 V, the film was smooth and translucent but not of even appearance. The second film was even and the third slightly rough, its thickness varying very considerably from place to place.

A smooth sparked film formed in the borate-silicate-tungstate solution at *p*H 11.4 in 12 minutes at an initial current density of 50 mA per sq. cm. and a maximum voltage of 70 V had a thickness varying between 7 and 14μ.

Composition. The approximate composition of an unsparked film formed in a borate-silicate-tungstate electrolyte to a maximum of 38 V was found by chemical analysis to be equivalent to 62 per cent ZnO, 19 per cent SiO_2, 11 per cent WO_3 and 8 per cent H_2O. A similar result was obtained for a green-yellow sparked film formed in a similar electrolyte containing potassium dichromate; only a trace of chromate was detected in this film.

Chemical properties of the film. A white film formed in the borate-silicate-tungstate electrolyte and detached from the basis metal was largely unaffected when treated with concentrated hydrochloric acid. A slight darkening disappeared on heating the film to a dull red heat in an oxidising atmosphere.

Treatment Using Square-Wave d.c. at Various Frequencies

Square-wave d.c. was tried at 50 c/s, 86 c/s, 500 c/s and 4000 c/s in a silicate-borate solution at *p*H between 11.1 and 11.3 and in a silicate-borate-tungstate solution at *p*H 11.6. Although sparking could be obtained for a lower power consumption, most of the resulting films were not sufficiently uniform.

The minimum current density required to raise the voltage to sparking voltage was lower with square wave d.c. at all frequencies than with 50 c/s a.c., the voltage in the silicate-borate solution rising fairly rapidly to sparking voltage at 38 mA per sq. cm., while in the silicate-borate-tungstate solution at 86 c/s sparking voltage was reached even at 12.5 mA per sq. cm., although the rate of voltage rise was less than 1 V per minute. Sparking voltage was generally higher than in a.c. electrolysis, values ranging mostly from 120 to 170 V instead of 80 to 90 V for a.c. electrolysis. It is not known whether the sparking voltage depends on the frequency of the current. Current and voltage variations during sparking were observed on the cathode ray oscilloscope; sparking appeared to occur during the whole of the "on" period in some cases, but during only about the last third of the "on" time in other cases.

Sparking with square wave d.c. resembled sparking with smooth d.c. in being confined to one or a few points, which did however move over the surface of the film; the resulting films were not, in general, sufficiently uniform. Some smooth films were obtained in the silicate-borate-tungstate solution, but only at relatively high current densities, so that the maximum power consumption was not significantly lower than in the a.c. process.

Treatment Using Full-Wave Rectified d.c. at 50 c/s

Tests were carried out in a silicate-borate-tungstate solution at *p*H 11.2. No advantages resulted from the use of this form of electrolysis current.

The rate of voltage rise up to sparking voltage at 120-135 V was greater than 1 V per minute when the current density was only 15 mA per sq. cm. The appearance of the film was satisfactory when the electrolysis was stopped before sparking had started. Sparked films on the other hand, usually flaked or had a non-uniform appearance. Current and voltage fluctuations during sparking were observed in the usual way. Usually, only single sparks were seen.

Treatment Using Half Wave Rectified d.c. at 50 c/s

Formation of Films

The favourable aspects of a.c. and smooth d.c. electrolysis were combined in this current form. the films were fairly smooth as in formation with a.c. and the power requirements were the same as with smooth d.c. No additional advantages were discovered.

The minimum constant current density required to raise the potential to sparking voltage was about 25 mA per sq. cm. in a borate-silicate-tungstate solution at *p*H 11.4. Sparking voltage in this electrolyte was about 140 V, *i.e.*, considerably higher than when the same solution was electrolysed with a.c. Still higher sparking voltages were observed in other electrolytes. Sparking occurred only at isolated points at relatively low voltages but tended to become more general over the surface of the film as the voltage rose.

Abrasion Resistance of Films

Although the films produced in silicate-borate-tungstate solution at 25 mA per sq. cm. were smooth and uniform, their abrasion resistance—determined by a falling abrasive method described previously—was only between 200 and 600 ml. A series of tests was therefore carried out in which, starting with current densities of 50 mA per sq. cm. or 100 mA per sq. cm., the current density was lowered to 12.5 or 25 mA per sq. cm. when the voltage had reached 50 V, or 75 V, or sparking

voltage. Abrasion resistances around 4000 ml. were obtained when the initial current densities of 50 mA per sq. cm. and 100 mA per sq. cm. were reduced to 25 mA per sq. cm. and 12.5 mA per sq. cm. respectively when the sparking voltage had been reached.

When the temperature of the electrolyte was lowered from room temperature to 0°C., the abrasion resistance remained low even when high initial current densities were used.

When a borate-silicate electrolyte was used instead of a borate-silicate-tungstate solution, the abrasion resistance of the films was generally fairly low. The sparking voltage was higher, at about 180 V, than in the solution containing tungstate.

Small additions of lead of the order 0.05 gm. per l. were made to the silicate-borate solution by dissolving lead in it anodically. The addition had the effect of increasing the abrasion resistance of the films considerably, the highest value lying between 6000 and 7000 ml. for a film formed at 25 mA per sq. cm., the current density being reduced to 12 mA per sq. cm. at sparking voltage.

Attempts to Prepare Translucent Films on Zinc

The incorporation of lead in the electrolyte was expected to lead to a lowering of the melting point of the material on the electrode and although the films appeared to be more glassy no translucent films were found. It was not possible to dissolve greater quantities of lead in the electrolyte.

Further attempts to produce translucent films of relatively low melting points were made by anodising in borate-silicate-phosphate solutions containing sodium phosphate at various concentrations up to 100 gm. per l. at *p*H about 11.5. No translucent films were obtained. Minimum current density and sparking voltage were similar to those observed in borate-silicate solutions but the sparks appeared to be finer.

In general, films isolated from the basis metal appeared to be glassier on the surface away from the metal than on the surface adjacent to it, suggesting that an opaque film is formed initially, and is not transformed into glass near the metal because the metal conducts away the heat of the spark too rapidly. It seems therefore that if a wholly translucent film is to be produced, the first layer at least needs to be translucent as formed and sparking must then begin before the initial layer is overlaid by any considerable thickness of more opaque material. An attempt was made to accomplish this by forming the coating in two stages, the normal process contributing the second stage.

Using a solution of 50 gm. per l. borax it was found possible to form fairly uniform transparent films at 6 or 12 mA per sq. cm. The *p*H of the solution was adjusted to between 11.5 and 12. The abrasion resistance of the films was less than 200 ml.

In initial tests it was found that the current tended to increase at constant voltage when the preformed electrode was further electrolysed in a silicate-borate solution. This could be avoided by preforming, in the borax solution up to a voltage of 150 V. No conditions were found, however, under which the film was translucent after re-anodising in silicate-borate or silicate-borate-phosphate solution.

DISCUSSION

Practical Considerations

In tests with small zinc samples the most advantageous method of producing hard electrolytic coatings was anodic oxidation with half-wave rectified d.c. in a borate-silicate solution containing small quantities of lead. Other forms of electrolysing currents had severe drawbacks; thus, the maximum power required for films formed with 50 c/s a.c. was 12 kW per sq. dm., compared with 0.25 kW per sq. dm. for films formed with half-wave rectified d.c., the power requirement of this process being similar to that of hard chromium plating and about ten times as much as that of the anodising of aluminium. Other forms of d.c. current produced uneven films.

The process using half-wave rectified d.c. was not tried out on larger zinc alloy die-castings. Films on small samples were hard and fairly smooth and they had abrasion resistances of up to 7000 ml., *i.e.*, of the same order as decorative coatings on anodized aluminium. The method used in this work for measuring the abrasion resistance may not, however, reproduce the type of abrasion by fine dust or by rubbing, for example, to which die-castings would be subjected in practical use. The abrasion resistance of the films is thought to be quite satisfactory for certain applications such as door fittings etc. Under conditions of sharp impact however the coatings, which are inherently brittle, would spall relatively easily.

It has not been possible to form translucent films, except very thin ones. Films with a greenish-yellow colour were formed with a.c. when sodium dichromate was added to the electrolyte. All other attempts to introduce colour into the films were unsuccessful.

The resistance to atmospheric corrosion has been tested on articles with coloured films and was found to be rather limited. It is not known whether this was due to the porosity of the film or to its lack of intrinsic resistance to corrosive attack. The resistance to corrosive attack of articles coated with uncoloured films has not been assessed, but, the good resistance of an uncoloured, isolated film to concentrated hydrochloric acid suggests that the material of this film is not likely

to suffer atmospheric attack, so that attack on the basis metal coated by this film could presumably occur only if the coating were porous or damaged. If the film did have pores it might be possible to seal them by impregnation with organic materials as is done with H.A.E. films on magnesium, which in many respects resemble the films described here.

Commercial die-castings have been treated only with a.c. It was found that the maximum power requirement for treating large samples was only about one sixth of that for small ones, the period of electrolysis being between 30 and 60 minutes. It must not be concluded however that there would be a similar reduction if commercial die-castings were anodised with half-wave rectified d.c. In tests with a.c. the appearance of the die-castings was the same after treatment whether or not they had previously been polished, flow lines being covered. Particularly intricate castings could not be treated successfully, a loose white material forming in the recesses, but the covering power is good when the recesses are not very narrow.

It is generally considered that although the present method is considerably simpler than the two-stage process developed previously, the appearance of the coatings is not sufficiently attractive to enable them to compete with anodised coatings on aluminium.

General Considerations

The composition of the films

Analytical results suggest that the composition of the films is independent of whether or not sparking has occurred. While zinc oxide is probably formed by direct combination of zinc and oxygen, the other oxides may become part of the film by discharge of silicate and tungstate anions, the high water content of the films suggesting that the anions remain hydrated during the discharge process. The state of combination of the components of the film is unknown. After sparking, the partly glassy film was largely amorphous with a small proportion of zinc oxide of grain size 10^{-5} to 10^{-6} cm. as shown by X-ray diffraction analysis. Inspection of sparked films under the microscope has sometimes shown that the glass globules, but not the remainder of the film, were coloured, suggesting that at least some reactions occur during sparking that do not occur without it.

The formation of anodic films containing oxides derived from anions in the solution, *e.g.* phosphate and chromate, has frequently been reported, but no mention of the presence of silicate or tungstate is known to the author. The incorporation of tungstate is similar however to the incorporation of aluminium and manganese oxides in the H.A.E. films on magnesium from aluminate and manganate ions in the H.A.E. electrolyte.

The molecular composition of the films is 42 mol. per cent ZnO, 18 mol. per cent SiO_2, 4 mol. per cent WO_3, 36 mol. per cent H_2O. Glasses of a similar composition do not appear to be known but might well be formed by the rapid cooling of the material fused in the electric spark. The solubility of tungstic acid in glasses is well known[4].

Growth of films on zinc and zinc alloy electrodes in silicate-borate and similar solutions

When anodic films are grown in silicate and similar solutions, the electrical resistance of the anode increases in a way similar to that observed during the formation of anodic films on zinc in sodium hydroxide-sodium carbonate solution[1]. During the electrolysis of silicate and similar solutions, however, metal oxides or hydroxides derived from complex anions in the solution are incorporated in the anodic film and the minimum current density required for film formation in these solutions is smaller than in sodium hydroxide-sodium carbonate solutions.

Differences between the anodic processes in the two solutions become more apparent when the sparking voltage is reached. Films of zinc oxide formed in sodium hydroxide-sodium carbonate solutions are disrupted at this stage, while glass globules tend to form on the mixed oxide films formed in silicate solutions. Growth of the film is probably very much more rapid during the passage of sparks, which explains why sparked films are very much thicker than unsparked ones, the similarity of the compositions of sparked and unsparked films suggesting that the anodic process is still essentially the same.

The passage of sparks through anodic films at high voltages is well known and has been studied in detail for a variety of metals[5]. It is known to cause physical changes in the anodic film and it may play an essential part in commercial electrolytic processes that use high voltages, *e.g.* the H.A.E. process. In the case of films on zinc not only is the rate of growth of the film accelerated by sparking and its hardness possibly increased, but sparking also causes flow marks and grain boundary marks to be hidden because the shape of the globules is determined solely by the zone of melting around the sparking channel.

It has been reported that the distribution and mobility of sparks on anodic films on aluminium etc. depends on the electrolyte[5]. If a spark stayed in one position or in one small area on an anodic film on zinc the resulting glass globule would become relatively large and the film would be rough. A dependence of the roughness of films formed with smooth d.c. on the composition of the electrolyte has in fact been observed, but

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The Formation of Hard Films on Zinc Surfaces

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none of the films was sufficiently smooth. Whatever the factors that control the duration of sparks with smooth d.c., they will presumably not last longer than 1/100 sec. when 50 c/s a.c. is used. Films were in fact found to be much smoother under these conditions. Unfortunately the minimum current density required to cause film formation to start, rose with the use of a.c., possibly because of the increased *p*H of the electrode layer in the cathodic part of the cycle. With 50 c/s half-wave rectified d.c. which has a period of zero impressed voltage, instead of the reverse voltage of the a.c. cycle, smooth films could be produced at current densities as low as the lowest used with smooth d.c. The interval of 1/100 sec. between successive voltage pulses is apparently sufficient for compact glass globules to form and solidify, thus preventing the next spark from arising at the same point.

Similarly, it appears plausible that 50 c/s full wave rectified d.c. may not allow sufficient time for solid globules to form so that sparking can occur repeatedly in the same part of the film. The difficulties of forming uniform films with square wave d.c. at frequencies generally in excess of 50 c/s can probably be explained along the same lines, although this explanation fails to account for the differences observed between 50 c/s square wave d.c. and half-wave rectified d.c. It should be noted however that the total heating effect of 50 c/s square wave d.c. is considerably greater than that of 50 c/s half-wave rectified d.c.

The electrolyte

Hard or compact films appear to be formed only in the presence of at least one of the glass-forming radicals—silicate, borate and phosphate. It is clear furthermore that the presence of one of these radicals is not a sufficient condition for forming a compact film. Thus, tests in which a solution of sodium silicate (waterglass) was used as an electrolyte by itself or in the presence of a variety of other acid radicals were unsuccessful. The only successful electrolytes discovered so far have contained silicate together with one or more of the radicals borate, phosphate and carbonate, or phosphate and borate by themselves.

It is suggested that one of the important functions of the second radical in the formation of compact sparked films is that it lowers the melting point of the anodic product, a relatively low melting point being essential if sparking is to have a constructive rather than a destructive effect on the film. The incorporation of lead or of borates, phosphates or carbonates into an oxide or silicate mixture would be expected to lower its melting point.

Some of the radicals added to sodium silicate solution, *e.g.* sulphate, probably led to poor results because they increased the ability of the electrolyte to dissolve the primary anodic product, presumably ZnO. Similarly the solubility of the primary or even secondary anodic product was probably too high in borate-phosphate mixtures at relatively low *p*H values and borate-silicate mixtures at relatively high *p*H values.

Acknowledgments

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FINISHING COMPANIES EXHIBIT AT ENGINEERING CENTRE

DURING a week early in March a joint exhibition of equipment and processes was staged at the Birmingham Engineering Centre by Modern Electrolytic Patents and Processes Ltd. and the European Metal Finishing Division of Roto-Finish Ltd.

The exhibition was supported by demonstrations of some of the processes, including the M.E.P.P. electropolishing processes as used on brass, nickel silver and other copper alloys. These processes lend themselves to incorporation in an automatic line giving greatly increased rates of production at a lower cost than manual polishing with the minimum of problems associated with fume extraction and effluent disposal. Samples of electropolished components made from stainless and alloy steels were also on view as were examples of the application of the process to electro-deburring.

Roto-Finish European Metal Finishing Division demonstrated a range of new finishing processes now being introduced to the U.K. and the opportunity was taken of giving the first public demonstration in this country of Schoeller ultrasonic cleaning equipment. Other processes demonstrated were Schering Ag 0-56 bright silver, Argalin protection against tarnish, Neorapid bright zinc and the Tridur coatings for aluminium, zinc, cadmium and magnesium ; the Atram phosphating processes, including the Atram O.S. cold and Atram B accelerated manganese processes, Grisiron cleaners and a number of other specialized treatments.

Unusual Tower Construction of Electric Enamelling Furnace

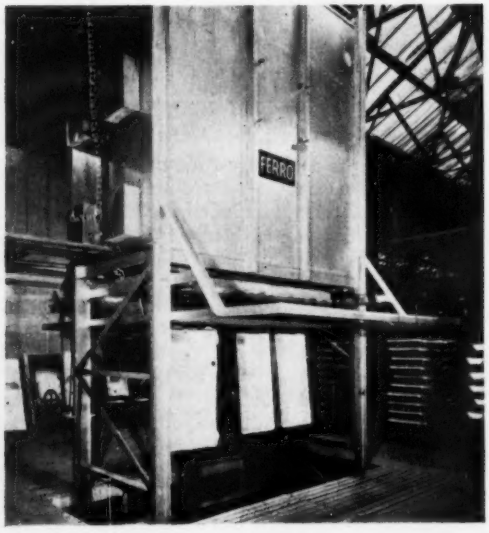
AN unusual type of furnace recently designed and constructed by Ferro Enamels Ltd. for the Tipton Enamel Co. (a subsidiary of Revo Electric Co. Ltd.) has shown some notable results in terms of thermal efficiency. The style of the furnace is in the form of a tower, the casing being mounted on four legs so that the base of the furnace is about 9 ft. above the shop floor.

The tower furnace was originally designed and installed for firing extra large fluorescent reflector troughs, but it was found to be so flexible in operation that it was used for the firing of double drainer sinks and cooker parts. This furnace was designed for firing such articles that were best fired in a hanging position, but are too large to be fired on a normal 'U' type continuous furnace or the conventional box furnace.

The vertical construction of the furnace requires very little floor space in relation to the conventional box-type furnace using double charging forks, and leaves more room for the operators and the movement of the ware. The heat loss from the furnace when the doors are open is negligible, so the operators are not disturbed by the heat emerging from the furnace during the loading and unloading periods.

The greatest heat loss is when the ware is discharged from the furnace after firing, the ware emitting more heat than is done by the actual opening of the furnace doors.

A view of the tower furnace showing ware on the suspension bars



The bottom of this particular size of furnace is about 9 ft. above the shop floor, but for firing articles less than 8 ft. long, this height could be decreased. The overall height of the furnace shown is 32 ft., the top part carrying the lifting gear being housed in a simple dormer construction on the factory roof. The furnace casing is supported on four legs, which form part of the furnace structure.

On the underside of the furnace are mounted two sliding doors which are controlled by one hand lever. The doors are filled with insulating material and are supported on end runners. The opening of the doors is controlled by one manually operated mechanism which opens or closes the doors as required. For supporting the ware the furnace is equipped with two suspension bars, which are carried on a transfer frame which travels under the furnace door. This allows for one bar to be at the unloading position while the other is in the furnace charging position. On the suspension bars is fitted a series of coat hangers, from which the ware to be fired is hung.

The suspension bar, loaded with ware, is engaged with two alloy rods that drop down through the furnace firing chamber and door opening to a position over the suspension bars. Once the rods are engaged into the suspension bar lifting eyes, they are raised into the furnace by means of an electric hoist. The rods travel through specially designed guides in the furnace roof, where they are connected by means of a steel yoke, to roller chains which travel over sprockets and are in turn connected to the electric hoisting mechanism. The travel of the rods is controlled by means of a series of limit switches, so that they stop in the same position in the furnace at all times. The hoisting mechanism is controlled by means of a pendant switch located near the door opening gear, so that one operator can control the whole sequence of loading and unloading.

The furnace is electrically heated having an installed load of 200 kW, which is controlled in two zones, one in the top part of the furnace, the other in the bottom part. The elements are displaced over the sidewalls only, which gives a very even heat distribution throughout the furnace.

To take care of each zone the furnace is supplied with two indicating temperature controllers and one three-point temperature recorder. Two dual

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NEW THERMO-CHEMICAL TECHNIQUES-2 *Powder Metallurgical Applications*

by P. GALMICHE, Ing. Dr.

(*Continued from page* 116, *March*, 1959)

Protection against Wear of Material used in Powder Compacting

WHEN chromium diffusion is applied to carburized metals in conditions which enable the avoidance of any decarburization of the surfaces, by heating of the parts in granulated chromium with the addition of a little ammonium fluoride, and in certain cases of an inert diluent, the result is the production of very smooth surfaces, stainless as well as very hard with a base of chromium carbides. The hard chromized surfaces thus formed have excellent sliding characteristics and so ensure very good protection against wear and abrasion, either cold or at high temperature. The coefficient of friction of chromized surfaces can be still further improved by a short electrolytic polish in Jacquet baths with perchloric acid, acetic acid or, in some cases, by annealing in fluorized atmosphere.

The steels from which dies and core rods for powder compacting are generally made, carburized chromium steels, are particularly suitable for the hard chromizing treatment, all the more so since the ONERA technique enables the heating conditions suitable for the metals under treatment to be observed, especially as regards speeds of heating and cooling. Annealing, preceding the heat treatment for regeneration of the mechanical properties of the treated workpieces, can be done without risk of decarburization in the ammonia atmosphere used for the protection of the chromizing boxes owing to the great stability of chromium carbides. It is also possible to do the heating in salt baths or, in certain special cases such as self-hardening steels, to do the whole treatment in a closed vessel in the presence of fluorized compounds.

The hardness of the surface layers obtained (about 2,000 Vickers), together with the surface quality obtained from chromium diffusion in fluorized atmosphere (Fig. 6), results in a considerable increase in service life of the parts. As the addition of chromium takes place without any removal of iron from the parts, the process can be applied for the protection or building-up of worn parts, after mechanical polishing or grinding. It is, moreover, possible in certain cases to make the parts in ordinary carburized steels, the surface layers formed by hard chromizing being, in any case, made up of chromium carbides.

In the same way as for protecting steel used for powder compacting, hard chromizing results in a considerable improvement in the service life of extrusion, cold-drawing and high-temperature dies of many metals or alloys (Fig. 7), these parts being generally made of carburized chromium-tungsten steel, or sometimes of non-magnetic alloys (18/8).

Protection of Sintered Iron Parts

Chromium diffusion is one of the few solutions for effective protection of sintered iron and steels, against corrosion both cold and at high temperature. The treatment can, in certain cases, be carried out at the same time as the sintering of parts of iron, nickel or alloy powders, the temperatures and lengths of the two operations being suitable for this.

The quality of protection of ferrous parts is essentially linked with the initial porosity of the treated parts. It is particularly high when the treated parts have a low porosity, as the addition of chromium completes the sealing up of the pores.

When the protection given by this treatment is too low because of the excessive porosity of the parts in the first place, it is possible to improve the resistance to corrosion of the chromized parts by selective oxidation of the surface zones rich in chromium. The oxidizing treatment is most frequently done by heating the parts in ordinary electrolytic hydrogen, which always contains traces of oxygen. The chromized surfaces fix the oxygen by progressive sealing-up, while the iron inside the parts remains unaffected owing to the low stability of iron oxide in the presence of hydrogen.

Protection of dynamically-free metal powders The problem of obtaining iron powders dynamically free and coated with diffusion layers of perfectly regular thickness and with a predetermined chromium content arises in the case where such powders are to be used as energy transmission agents between movable magnetic plates. It is known that, in these conditions, the temperature of the particle surfaces can reach periodic temperatures of the order of 700°C.

A special technique for doing this simply has been developed[4] in which the added chromium,

added in a very fine form or set up *in situ*, is completely used up during the operation carried out at about 950°C. without it being possible for the iron particles to agglomerate (Fig. 8). It is thus possible to get precise and reproducible results. The iron powders treated in such an operation show a magnetic permeability almost equal to that of pure iron powder. They are not remanent and resist oxidation up to about 700—750°C. The maximum temperature for using coated powders can be raised either by carrying out a controlled oxidation of the metal after chromizing, or by applying mixed cementation (Cr-Al or Cr-Zr).

When the treated powders or granules are carburized, this results in very hard surface layers being produced, which allow of the materials being used as abrasives.

The treatment can also be applied in a similar way to powders or fibres of various metals or alloys which can be cemented by chromium (13 per cent Cr magnetic alloy, nickel, cobalt, molybdenum, etc).

It is also possible to obtain ductile powders of chromium alloys, completely free, by increasing the temperature or the length of the operation (iron-chrome ; iron-chrome-aluminium ; nickel-chrome). These powders can be subsequently sintered or chromized-sintered).

Sintering of chromium-bearing metal powder[5] Sintering of alloy powders with high chromium contents is difficult owing to the thin skin of oxides which is present or tends to form on the particle surfaces during the operation. Accordingly, sintering of such powders is usually done in pure hydrogen.

When the compressed powders, placed in a sheath of chromium or supported by an inert diluent, are heated in a reducing atmosphere halogenized at equilibrium similar to those used for bright annealing or chromizing annealing, a quantitative elimination of the chromium oxide skin take place from the beginning of the operation, even if the treatment boxes are heated in non-purified reducing atmospheres. The operation leads, moreover, to the decarburization and purification of the powders under treatment, which results in high-density products being obtained after sintering, these being relatively very ductile and perfectly homogeneous in structure ; this is all the more marked as the use of halogenized atmospheres in the treatment gives rise to a considerable activation of the sintering owing to the movement of metal in the gaseous phase (Figs 9 and 10). The use of fluorized reducing atmospheres in treatment in equilibrium can be generalized for activating sintering of various metals and alloys of which the halogenides are not very volatile and are reducible by hydrogen.

When the sintering treatment in fluorized atmo-

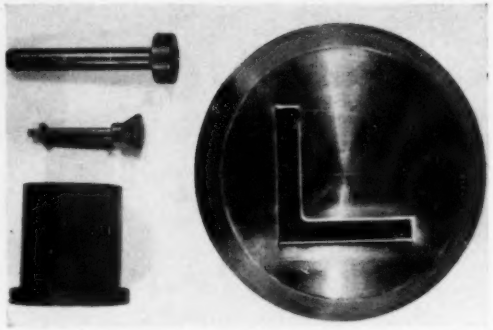


Fig. 6.—Pressing and extruding parts, treated by hard chromizing.

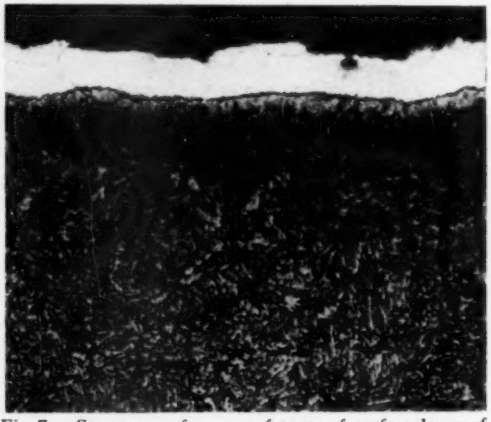


Fig. 7.—Structure, after use of part, of surface layer of collar of steel-extrusion die, hard chromized. Etched hyposulphite-bisulphite.

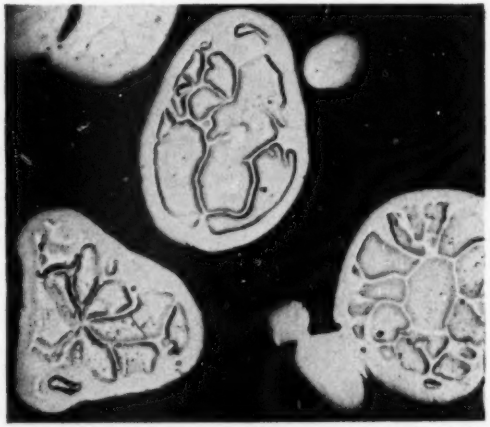


Fig. 8.—'Densified' chromized iron powder. Etched nitric alcohol. × 500. Note penetration of chrome along the grain boundaries, assuring protection in case of breakage.

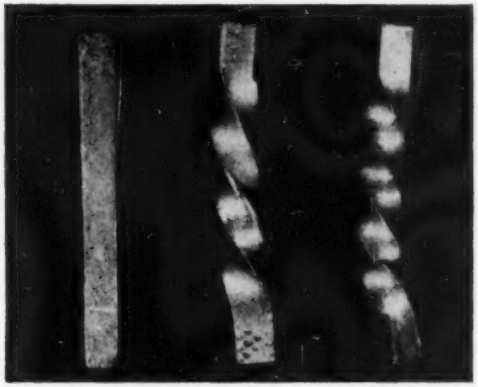


Fig. 9.—Samples of 18/8 alloy sintered in fluorized atmosphere and twisted to show ductility of material.

Fig. 10.—Structure of 18/8 stainless steel powder sintered in fluorized atmosphere for 1 h at 1,150°C. Absence of any precipitation at grain boundaries has necessitated a special metallographical etch (hydrochloric-hydrofluoric in alcohol. × 200).

sphere is carried out, not on the chromium alloy powders, but on the powders of the constituent elements of these alloys, the chromium is brought to the particle surfaces of the base metal by ' internal gaseous chromizing, ' which improves still more the quality of the sintering and makes the operation cheaper owing to the use of basic products which are less costly than the alloy powders.

Plastic Chromium Powder and Dense Machinable Sintered Products[6]

Chromium is usually considered to be a hard, brittle metal, from which it is not possible to make articles by machining. Also, sintering of chromium powder is difficult because of the great sensitivity of chromium to oxidation. This operation has to be carried out usually at temperatures of the order of 1,400—1,500°C in purified hydrogen so as to ensure the production of very cohesive parts free from oxide.

Compacted parts obtained from electrolytic chromium powder, the most usual form in which the pure metal is supplied, are highly porous and very brittle. It is in any case essential to add a binding lubricant to the powder before pressing.[7]

These various drawbacks have, up to now, prevented chromium parts being used, although this metal has the considerable advantage of having a high melting point (1,900°C), together with good heat conductivity and of being inoxidizable up to about 1,100°C.

It has been established that the brittleness of chromium is due to the presence of impurities very difficult to avoid or remove (oxygen, nitrogen). Various authorities have recently succeeded in obtaining specimens of ductile chromium, in particular by purification of electrolytic chromium specially prepared and heated to a high temperature (1,200—1,400°C) in perfectly pure hydrogen.[8][9] Others have made use of the reduction of very pure chromium chloride[10] or the dissociation of the iodide.[11]

In the process developed by ONERA[12] purification of the chromium is effected on the powder without any agglomeration of the granules, in a simple way and at a relatively low temperature (about 1,100°C), by the action, under specific conditions, or reducing atmospheres halogenized at equilibrium, notably

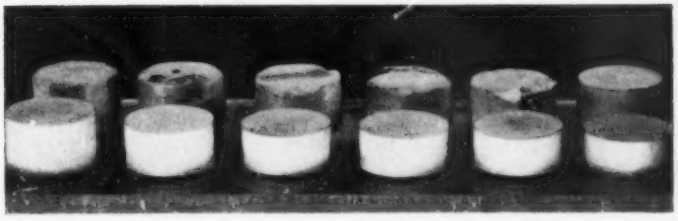


Fig. 11.—Compressibility, as a function of pressure applied, of fine treated electrolytic chromium powder and of original powder (15 g samples : pressures ranging from 1—6 t/cm²).

bromized atmospheres. The process allows of the treatment, without limit of quantity, of the powder in conditions easy to obtain. The protective atmosphere of the treatment boxes is most frequently of ordinary electrolytic hydrogen.

As purification of the powder is for a great part linked with the diffusion of impurities towards the particle surfaces, from whence they are removed, the treatment is particularly applicable to fine electrolytic chromium powder or magneso thermic chromium powder produced direct by the ONERA HIVERT-TACVORIAN process.

Chromium powder submitted to the action of atmospheres halogenized at equilibrium in the ONERA technique is quantitatively de-oxidized at the beginning of the operation, even if additions of chromium oxide have been made (*e.g.* to improve later decarburization). Metallic impurities of chrome are also eliminated (silicon, aluminium) in the form of volatile halides, and also sulphur in the form of suplhuretted hydrogen. The chromium particles, however, remain practically unattacked owing to the high boiling points of chromium halides and to their instability under treatment conditions. The same thing occurs in the treatment of powders of chromium alloys, *e.g.* 18/8, 25/10 and Nimonic powders.

The fine powder of eletrolytic or magnesothermic chrome, refined by the halogenizing treatment, has a totally different appearance and compactibility from the original powder with its initial dark-grey colour. The treated powder is of a clear silvery grey colour and its cold compactibility characteristics, as a function of the pressure applied, are similar to those of iron powder (Fig 11). Pressing can be done either cold or hot without risk of sticking, using the same standard equipment, even if no binder has been added to the powder as a lubricant. The pressed powder has a bright appearance, is of high density and not brittle[14] however complex the components made from it may be, and it is possible to produce from it thin plates or flat rings (Fig. 12). Sintering of ductile chromium powder can be done at a fairly low temperature, without shrinkage or internal oxidation (parts are bright white when sintering is done in fluorized atmosphere). The products obtained have a very high mechanical resistance cold or hot, 9 kg. per sq. mm (6 tons per sq. in.) with cold-bend tests of 28 kg., and 31 kg. per sq. mm. (18 tons and 20 tons per sq. in.), on samples originally pressed at 5 tons per sq. cm., sintering being done at 600°C, 875°C and 1,130°C respectively. The hardness of the material obtained is not high in spite of low porosity (60—90 Brinell-Vickers) for samples sintered between 875°C and 1,700°C. The material has a very homogeneous structure (Fig. 13), is only slightly brittle cold and is very

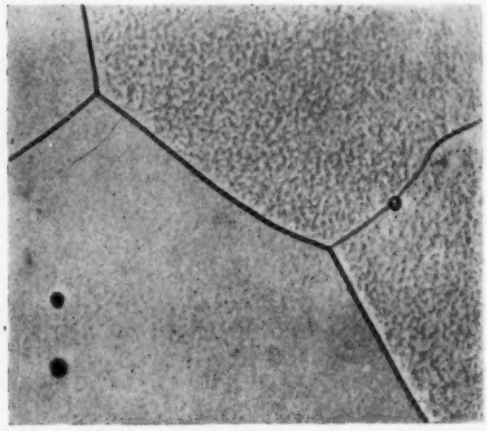


Fig. 13.—Structure of ductile chromium powder sintered at 1,700°C after pressing at 5 t/cm². Etched anodic soda. × 2,000.

Fig. 12.—Various components made by pressing from ductile chromium powder.

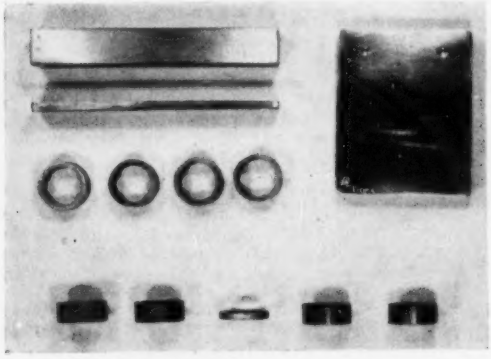
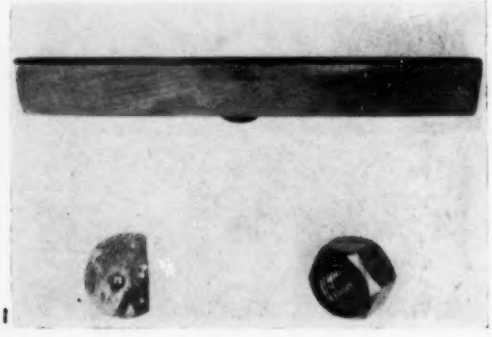


Fig. 14—.Various samples machined from ductile chromium powder, sintered at 1,150°C. Cold pressed at 5 t/cm². Note hardness reading impressions on cylindrical specimen.



ductile at high temperature. It can be calibrated, re-repressed cold or hot after pre-sintering, forged or even rolled at not too high a temperature. Re-pressing of samples, pre-sintered, followed by a further sintering or annealing, allows of products being obtained of which the density is near to the theoretical density of chromium and of which the mechanical characteristics are changed. Thus, re-pressing of samples pre-sintered at low temperature enables products to be obtained with a very high density and with a hardness which can exceed 200 Vickers on samples re-pressed cold under a load of 6 tons per sq. cm. This hardness decreases progressively as a function of the annealing temperature and becomes stable after 1,000°C, at values of about 100 Vickers. Microscopic examination shows evidence of recrystallization of the material.

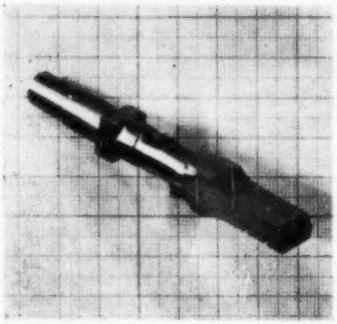


Fig. 15 *and* 16.—*Parts machined from block of ductile chromium powder, pressure* 5 *t/cm². Pre-sintered at* 900°*C and re-pressed (density* 6.84). *Sintered after machining at* 1,150°*C.*

Materials so obtained by sintering can be machined cold like steel (Figs. 14 to 17). In the case of parts to be made from re-pressed blocks, machining can be done either direct on the products re-pressed cold or hot, or on blocks annealed after pressing. Finish-machined parts can also be given a further annealing or sintering. When articles in sintered chrome are porous owing to low initial compaction, it is possible to seal up the pores by impregnation in a fluorized atmosphere or by controlled oxidation of the surface zones. This last operation is done by gradual heating up in air or in damp electrolytic hydrogen and results in the formation of a very hard surface layer with a melting point higher than that of chromium, which can also play the role of heat protection.

In addition to the production of articles in pure chromium, such as fuse parts, sheaths for heating or burning elements, rods for welding or scooping, the use of ductile chromium powder has already been envisaged for making, by sintering, both alloys with a chromium base (Cr-Mo-Fe: Cr-Mo-U) and also composite materials in which chromium, in association with compounds such as certain oxides, plays the part of an inoxidizable ductile constituent. It is also possible to obtain by sintering at not too high a temperature, starting with ductile chromium powder, which does not shrink during sintering, complex articles such as objects in chromium reinforced with fibres of different metals or alloys (Fe: Ni: Mo: W, etc), or also composite sintered articles of which only a portion is made from chromium powder (Fig. 18). The ONERA

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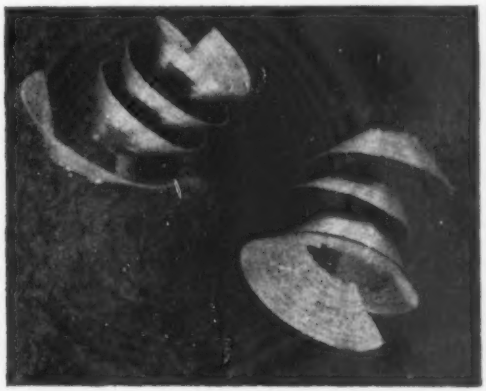
Fig. 17.—*Chromium turnings produced from machining parts.*



Developments in Barrel Polishing • *A New Range of Equipment*

THE new range of " Lacromatic " barrel polishing machines, manufactured by The Hockley Chemical Co. Ltd., Birmingham, incorporates a " double-cone " design. These barrels are available in five sizes from ½ cu. ft. to 5½ cu. ft. representing workloads of approximately 10-lb. up to 100-lb. of parts. This bridges the gap between the small table models and the larger horizontal barrels available in sizes suitable for workloads up to 5-cwt. The barrels are lined with a special double rubber or plastic to prevent damage to delicate parts and to protect the barrel itself. Variable-speed drive makes them suitable for a wide variety of work ; two fixed speeds are provided if required.

The shape of the barrel is virtually that of a standard type of octagonal horizontal barrel plus two octagonal cones. Usually the barrels are loaded up to the centre level, and this ensures that during rotation there is the maximum length of slide of the surface of the chip mass, *i.e.* a slide through a distance of one diameter. The double cones with their decreasing diameter do not, as might be expected, reduce the action ; instead, the flinging of the work mass from each side towards the centre means that the work is subjected to a three-fold action (Fig. 1). It has been shown empirically that for a given capacity and speed the double-cone barrel produces more rapid deburring than the more orthodox horizontal octagonal barrel.

The standard barrels have a switch on the panel to actuate a mechanism to raise the mouth for loading and to lower it for unloading. Alternative cheaper models are available with a handle to tilt the barrel in this way. The size and height even of the largest double cone barrel enable the operator to transfer chips from the chip bin to the barrel quite easily and quickly with a shovel or scoop.

Quick-acting locks enable the door to be affixed and removed quickly with the minimum of effort,

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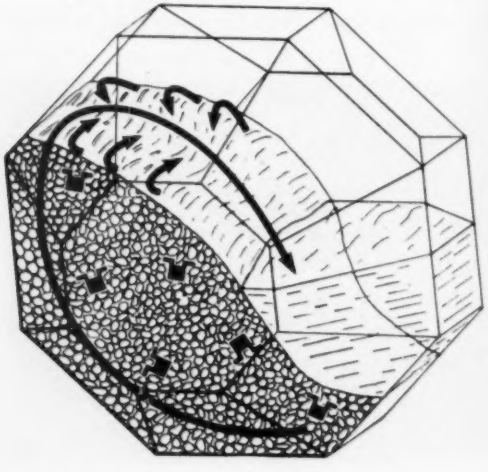
Fig. 1.—*Diagrammatic illustration of the three-fold action of the double cone barrel.*



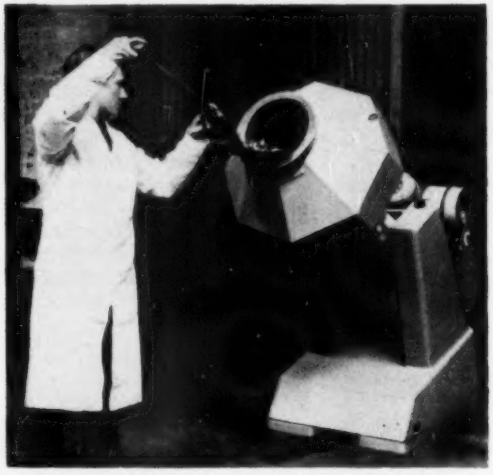
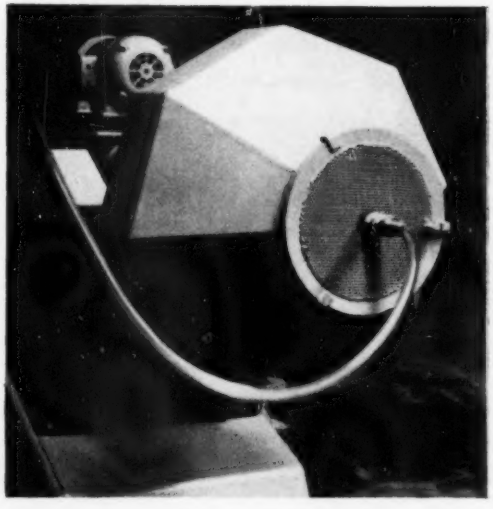


Fig. 2.—*Barrel in raised position for manual loading.*

Fig. 3.—*Hose connected to special coupling for flushing barrel and contents.*



Oil and Colour Chemists' Association

O.C.C.A. Exhibition

This is the second and concluding instalment of a description of the exhibition held during March by the Oil and Colour Chemists Association. The first instalment appeared in last month's issue of this journal.

Goodyear Tyre and Rubber Co. (Gt. Britain) Ltd., Wolverhampton.

THE company's "Pliolite V-T" multicolour paint was exhibited for the first time on the Goodyear stand.

Sometimes referred to as a "polka dot" or "speckled" coating the material produces a multicolour paint in one spray operation.

The paint consists of two phases—a lacquer phase in which pigments are dispersed, and a water phase containing water and a protective colloid. The lacquer phase is poured into the water phase during agitation. Due to the incompatibility of the two systems, small globules or flecks of lacquer are formed.

Pliolite V-T developed specifically as a solution binder for multicolour paints, is a lacquer-type drying resin soluble in mineral spirits. Introduced to the paint trade comparatively recently, the chemical is claimed to give paints the advantages of low odour, use of economical solvents, excellent pigment binding, non-lifting properties, high flash-point and good alkali resistance.

This vinyl-toluene-butadiene resin, of a thermoplastic nature is tasteless and enables the manufacture of films of unusual clarity, strength, hardness and chemical resistance, the makers say. The films are formed by evaporation of solvent, and not by oxidation. The various properties of the resin were illustrated in end-use applications that included traffic paints, paper coatings, adhesives laminates, printing inks, hot melts and abrasion resistant coatings.

Pliolite S-5, styrene butadiene, thermoplastic resin, soluble in aromatic solvents, was also displayed on the stand.

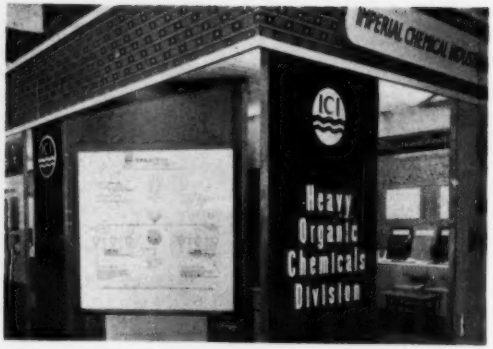
One of the outstanding properties claimed for Pliolite S-5 is its chemical resistance. Coatings based on this resin make it possible to paint most types of masonry surface without fear of paint failure, even by alkali attack. The coatings offer protection to floors, as well as structural steel, machinery and plant where spillage of chemicals presents a corrosion problem.

Producing a multicolour paint in one spray operation. "Pliolite" was introduced on the Goodyear stand.

Hercules Powder Co. Ltd., 1, Great Cumberland Place, London, W.1.

THE company featured ethyl cellulose used in solvent type strippable coatings and gel lacquers on this stand. A feature of the material used for the former purpose is that the company have been able to considerably reduce the cost by using a relatively cheap extender as a film former.

Strippable coatings designed to be applied from solvent systems for the temporary protection of highly finished surfaces have been known since the early post-war years. Such coatings were originally based on vinyl polymers, and their application was severely limited by the powerful nature of the solvents employed. In a published technical report, the company have previously reviewed the formulation of ethyl cellulose-based strippable coatings that can be applied over lacquer, enamel, and certain paint films, and have directed attention to its use as a packaging for industry. At present, rather specialised applications of this have been made. Wider adoption has been hampered by the relatively high cost of suitable film forming materials, and the need for multi-coat



The I.C.I. stand was shared by three divisions, each contributing material of interest to the finishing trades. New dyestuffs and materials for the manufacture of paints and varnishes aroused wide interest.

application to build up sufficiently thick films to give the protection against mechanical damage that is a feature of the coatings. A means of achieving thick strippable films giving a high degree of protection against mechanical damage at a fraction of the cost of materials hitherto available, representing recent work in the laboratories of the U.S. parent company, was shown on the stand. One example was an ethyl cellulose-based strippable coating incorporating a relatively high proportion of granulated cork that functions as a low-cost extender for the film-former.

Outstanding features of suitably formulated coatings of this nature are claimed to be : the granulated cork or other suitable low-cost filler can account for up to 75 per cent of the volume of the dried film ; and there is no reasonable limit to the thickness that can be applied in a single coat since there is little or no tendency to sagging of the wet film on vertical surfaces.

A suggested formulation suitable for spray application to lacquered surfaces and its method of preparation were described. The coating can be readily prepared in a conventional lacquer-type mixer. The company says that sprayed films of this coating applied by a suitable paint spray gun fitted with a $\frac{1}{4}$-in. nozzle, operating at pressures of 30 lb. per sq. in. on the material and 40-50 lb. per sq. in. at the nozzle for atomization, dries rapidly to a thick tough film providing a high degree of cushioning that can be removed when required in large peelings.

Gel lacquers based on ethyl cellulose provide a means of applying extremely tough strain-free plastic coatings of up to 35 mils thickness in a single dipping and forced drying operation. Examples were shown to illustrate that apart from such established applications as those where the gel lacquers remain in place by forming a tight shrink fit, offering little real adhesion, lacquers have been formulated to provide a smooth, high-gloss finish having adhesion on rough metal surfaces.

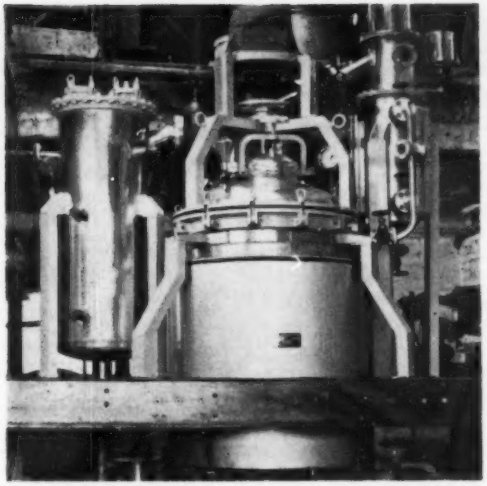
Another exhibit of interest to those concerned

with printing on metal surfaces for the packaging industry was a number of examples of decorated laminated foil produced and shown by courtesy of Reynolds Metals Co., Richmond, Va., U.S.A., to demonstrate the use of ethyl cellulose in the production of scuff resistant overprint lacquers. Having good initial colour, the inks were claimed to offer a high degree of resistance to discolouration by sunlight or ageing. Another claim made for inks made from this material is that its low specific gravity makes it possible to get greater coverage and greater volume per unit weight than with any other cellulose derivative. The examples that had been heat glazed had excellent gloss.

Imperial Chemical Industries Ltd., I.C. House, Millbank, London, S.W.1.

THREE I.C.I. divisions—Dyestuffs, Heavy Organic Chemicals and Nobel—shared a stand at the exhibition.

The Dyestuffs Division display illustrated a number of new dyestuffs, pigments and resins for



Heating mantles similar to this in use at Jenson and Nicholsons were displayed by Isopad.

the paints, plastics and allied trades. Monastral Fast Blue RFS—a new pigment possessing good non-flocculating properties—was prominently featured. The non-flocculating properties of Monastral Fast Blue RFS was demonstrated in comparison with existing phthalocyanine pigments.

A range of chrome pigments could also be seen, illustrated as paints and printing inks, to demonstrate their outstanding light fastness and durability. Modulac 147W, a new resin for use in glossy thixotropic paints, was on show in the resins section, while two new products—3X and 5X—in the 'Bedacryl' range of vinylated alkyds were featured. These products are claimed to have high gloss and build and dry swiftly. Isocyanates for wood lacquers were also shown.

The Nobel Division showed new and improved silicone resins for heat resistant paints to illustrate the effect of prolonged heating at high temperatures on silicone and conventional paints ; practical demonstrations were given.

Two silicone resin undercoats for emulsion paints were shown, claimed to be particularly suitable for rough surfaces such as cement rendered masonry. Two development products—trimethylol propane and neopentyl glycol—could also be seen. Trimethylol propane is used in the preparation of short-oil alkyd resins for stoving enamels, while neopentyl glycol is used in the production of esters, polyester resins and plasticisers.

The main feature of the Heavy Organic Chemicals Division's exhibit was high-purity terbutol (*p-tert*butylphenol), demonstrated for the first time. It is used as an intermediate in the manufacture of reactive and non-reactive varnish resins. The exhibit also covered octylphenol, another resin intermediate, and the comprehensive range of solvents made by the division for use by the surface coating industry.

Isopad Ltd., Barnet-ByPass, Boreham Wood, Herts.

ELECTRIC surface heaters as used in the paint and allied industries formed the exhibit on this stand.

The company's " Isomantles " are now used extensively for heating of alkyd resin plant, and the illustration shows an 80 gal. production plant (by R. and W. Winter) in use at Jenson and Nicholsons. Similar heating mantles were shown at the exhibition. Isomantles for drums facilitate emptying of viscous or solidified material, and are made for all standard drum sizes in vertical or horizontal positions. The equipment is available in the special flameproof construction utilising metal-sheathed heating elements, flameproof terminal boxes and controls. This design is approved by the authorities with its particularly robust construction carries a three year guarantee. " Isotapes " (electric heating tapes) were shown including new types for frost protection.

For use in the laboratory, a new unit for semi micro-analysis combining heating mantle and control, an inexpensive new type of heating tape and examples of the " Multisize Isomantles" as well as extraction units were shown. The manufacturer's 44-page catalogue illustrating electric surface heaters for process vessels up to 2000 gal. capacity, and for many other purposes were also available on the stand.

Isotope Division, Atomic Energy Research Establishment, Harwell, Didcot, Berks.

THE purpose of the exhibit run by the Division was primarily to show the way in which radioactive isotopes are helping other industries and in which they can help the paint industry.

The first technique to illustrate this was based on the very great sensitivity with which radioactive materials can be detected by electronic or other means—about a million times more sensitive than chemical analysis. This provides an entirely new tool for following the progress of all kinds of mixing processes, whether on a production or laboratory scale. There is virtually no limit to the applications of radioactive tracers in studying continuous production processes.

Another important application is in production instrumentation, where radiations from radioactive sources are " shone " upon or through materials under examination and the transmitted or back-scattered radiation is measured to indicate the thickness or density of the material. This technique is of particular value where material is being

produced in sheet form, where large areas of uniformly coated materials are being produced, or where a continuous check is required on the density or level of a fluid. The physical condition of the material under examination has no influence on the measurement and the technique is therefore applicable to conditions where measurement would otherwise be difficult or impossible, e.g., gases liquified under pressure, materials at a high temperature or of a corrosive nature.

Yet another application of major industrial importance is in non-destructive engineering testing, particularly the gamma radiography of welds and castings, and the detection of internal corrosion of pipes and vessels by gamma back-scatter measurement.

To demonstrate the comparative simplicity of these techniques (particularly in the field of tracer work) the exhibit included some typical apparatus for radiochemical laboratory work and radiation measurement.

Johns-Manville Co. Ltd., 20, Albert Embankment, London, S.E.11.

THE items on this stand of interest to the metal finishing industry were fast-flow filter aids and their pigment extenders that can be used in all types of flat finishes, and in stoving formulations.

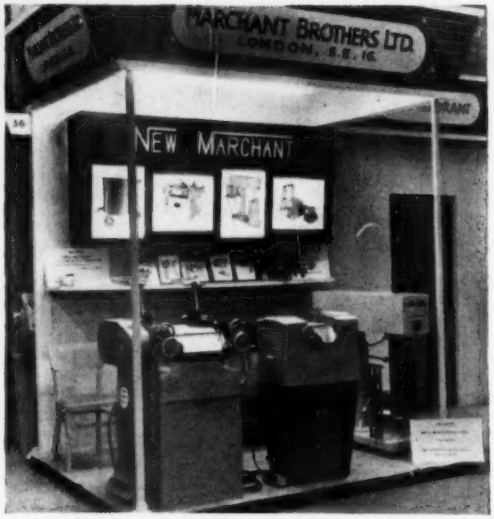
In electro-plating and galvanising solutions, Celite filter-aids are claimed to remove finer particles than filter-cloths, paper or stones. They can be used in any filter to ensure the removal of all sources of contamination such as finely precipitated compounds, anode muds, oil traces, stray abrasive air-born dirt, etc. They can be used for the clarification of solutions in the pH range from 3-12 provided the temperature is not too high at either extreme. Highly clarified plating or galvanized solutions lead to more uniform and thicker coatings of deposited metals, and the filtration can be continuous.

Available on the stand were typical formulations of stoving finishes that can be obtained using either Celite or Calflo pigment extenders. Advantages claimed for these types of pigment extender are that they impart excellent flatting and better sanding properties, and provide "tooth" for good inter-coat adhesion in heat cured finishes.

Johnson, Matthey and Co. Ltd., 73-83 Hatton Garden, London, E.C.1.

IN the production of Matthey cadmium pigments, care is taken to ensure the highest possible standard of consistency of colour and brilliance from batch to batch. The success of this rigorous production control was demonstrated by a graph showing reflectance curves for four samples taken from different bulk batches of pigments. Though absolute identity of colour and brilliance is very difficult to achieve, the curves show how minor are the variations to be expected in the Johnson Matthey product. These reflectance curves—the first stage in assessing a colour—were associated with a chromaticity diagram giving exact colour values. Other reflectance curves showed how accurately colour matchings can be made in the company's laboratories.

An excellent dispersion in a paint medium can be achieved with a short milling cycle. Because of the soft texture of Matthey pigments there is, in fact, a danger that brilliance can be reduced if the milling time is longer than is necessary. This undesirable effect was demonstrated by means of panels coated with paints milled correctly, and for an unnecessarily protracted period.



A new range of roll mills were displayed by Marchant Brothers.

Marchant Bros. Ltd., 60, Verney Road, Rotherhithe, London, S.E.16.

ON view here were examples of the new Marchant triple roll mills that comprise a range from 3-in. dia. x 6 in. to the largest size 15-in. dia. x 30 in. The mills are used extensively in many industries including paint and ceramics. Features of the new machines include re-designed water-cooling, easier adjustment, readily cleaned hopper cheeks, and enclosure of the electrics. The cooling system employs rotary valves and visual nylon service tubes enable the flow and purity of water to be easily checked. The machines were well finished in enamel with chromium plated fittings.

Also displayed was a chain driven mixer of 10 to 28 gallon capacity suitable for mixing heavy

glutinous compounds. The company has a design service for the development of special purpose machines employing hydraulic, pneumatic or electronic equipment.

Micafine Ltd., Raynesway, Derby.

RESULTS of recent investigations into anti-slip deck paints where the texture of the surface can be achieved cheaply by the addition of coarse sand were displayed. The introduction of mica has been found to be beneficial in reducing the hard packing tendency of the sand, and in aiding redispersion by stirring. For this purpose a special coarse grade of mica, E.1 mica, is preferred to finer grades, the company says, because this also adds to the overall coarse texture required.

Interesting results have been seen concerning the effect of P grade mica on the opacity of white pigmented P.V.A. emulsion paints. Additions of 10-20 per cent of mica based on the main opaque pigment are widely used in order to achieve improved scrub resistance, scratch resistance, and adhesion, but recent experiments appear to indicate that still larger additions of mica are possible without materially affecting opacity, according to the company. This may provide a means of making these paints more cheaply, and the explanation for this may be found in the optical properties of the mica flakes. Other types of extender examined appear to have a more marked effect in reducing opacity.

Surface treatment of pigments has been increasing in favour in recent years as an aid to dispersion by grinding, and recent research has provided a means of greatly facilitating the ease of dispersion of mica. Samples of treated mica have been produced with which, in oleo-resinous media, dispersion by simple mixing, as good as that obtained with untreated mica after several hours of ball milling, is possible.

Monsanto Chemicals Ltd., Monsanto House, 10-18, Victoria Street, London, S.W.1.

THE main feature of the display on this stand were phthalic anhydride and maleic anhydride, two important raw materials for the paint, varnish and lacquer industries. A range of end products stemming from derivatives of these materials was shown. The company is a major supplier of phthalic and maleic anhydride, and a further maleic anhydride plant is to be built at their Newport, Mon., factory. Other products on display included sodium benzoate corrosion inhibitor, and Santobrite (Monsanto pentachlorophenate), which protects surface coatings from attack by fungi and bacteria.

Printing, Packaging and Allied Trades Research Association, Patra House, Randalls Road, Leatherhead, Surrey.

VARIOUS items of equipment used at P.A.T.R.A. for studying ink behaviour were shown on the Association's stand. Of special interest was a laboratory-scale device for minimising ink fly that operates on the principle of air jets blowing the ink particles back into the nip region. Samples illustrating the performance of the device were on display.

Another exhibit was a working demonstration of equipment in which transparent rollers are used for observing the behaviour of ink films in the nip. Weissenberg's viscoelastic phenomena with media common to both printing inks and paints were also demonstrated.

An apparatus designed and built at PATRA for measuring the " tackiness " of adhesives and printing inks was also shown.

Reeves and Sons, Ltd., Enfield, Middx.

LAST year at the exhibition, the company introduced their range of pigments dispersed in various media. Since then, work has continued by the company's pigment laboratory staff to improve and increase the range and application of colours available in this form.

A new range of translucent pigments dispersed in a polyester resin has been made available and was shown as part of the stand design. These pigments are primarily for use with reinforced plastic roof lights. They show remarkable fastness to light even when used in low concentration. Work has also been carried out to improve the

Pigment dispersion in various media was the feature of Reeves stand.

range of colours available for P.V.C. pastes, especially colours to B.S. specifications.

The company has also carried out a research programme into methods of dispersion. Investigations, both in this country and abroad, have been made to obtain the most up-to-date methods and plant that will produce pigment dispersions of the highest possible order. Representatives of the technical staff were available on the stand to meet and discuss dispersion and colour problems with members.

The Research Association of British Paint, Colour and Varnish Manufacturers, Paint Research Station, Waldegrave Road, Teddington, Middlesex.

INSTRUMENT colour measurement and some of its applications to industrial colour matching were illustrated on this stand. The basis of all such work is that by reason of the trichromatic properties of the eye, any colour can be matched by additive mixture of three primary lights, a fact that was demonstrated.

The International (C.I.E.) system for colorimetry is based on the average colour response of the normal eye. Surface colours are expressed in terms of the amount and quality of light reflected. The colour quality could be represented on the " chromaticity diagram " with the amount of light reflected represented by ordinates erected at right angles to the diagram.

Colour measurements could be carried out by photoelectric means, provided that the response of the instrument to different parts of the spectrum was arranged to match the response curves of the eye. Colour measurements could be made rapidly and precisely with instruments that could be of considerable assistance in colour matching by indicating the magnitude and direction of colour differences from a standard. Similarly, it is possible to set up tolerances for production colour control.

The P.R.S. demonstrated instruments for colour measurement

Research Equipment (London) Ltd., 64, Wellington Road, Hampton Hill, Middx.

THIS year, in addition to their standard range of testing apparatus the company also exhibited two corrosion cabinets for use with sulphur dioxide and other gases. The cabinets are of similar design to those used for salt spray tests, but have thermostatically controlled heaters and circulating fans incorporated in the construction. Sizes are 18 in. x 12 in. x 12 in. and 36 in. x 18 in. x 14 in.

Union Carbide Ltd., 103, Mount Street, London, W.1.

INTEREST was centred on the range of products that are to be manufactured by the Chemicals Division of Union Carbide Ltd., at their new plant at Fawley, Hants., towards the end of 1959. Major features included special reference to the " Cellosolve " and " Carbitol " solvents, and " Tergitol " surface active agents.

In addition, the well known range of U.K. manufactured " Gemex " and " Nonex " surface active agents were displayed together with a number of products of American origin of interest to the surface coating and allied industries.

One unit on the stand showed viscosity comparison of " Cellosize " hydroxyethyl cellulose. The material displayed is available in five different grades, each having particular properties and characteristics when applied in different aspects of surface coatings. Grade WP-4400, for example, is a thickening agent for emulsion paints and has the highest viscosity reading of the range : grade WP-09, on the other hand, is used as a protective colloid for emulsion polymers.

Vinyl Products Ltd., Carshalton, Surrey.

THIS company featured their " Vinamul " synthetic resin emulsions and " Vinalak " polymer solutions in decorative emulsion paints, acrylic lacquer finishes and floor maintenance products ; several new products were also introduced.

Decorative emulsion paints : the exhibit showed that water spotting can be substantially overcome by basing emulsion paints on the new vinyl acetate-vinyl stearate copolymers now in their final development stage. Another display illustrated the importance of low temperature film formation on the performance of pigmented emulsions as sealing coats ; it was also shown that the drying oil compatibility of the vinyl acetate-vinyl caprate copolymer emulsions makes it possible to formulate

Products that will come from the new Union Carbide factory at Fawley by the end of this year, and a unit to demonstrate viscosity comparison were the features on this stand.

sealers of greatly improved binding properties for powdery surfaces. Another part of the exhibit demonstrated that the very high pigment binding properties of the vinyl acetate-vinyl caprate copolymer emulsions permitted the formulation of high opacity " one coat " paints of adequate wash resistance.

Acrylic lacquer finishes : the exhibit featured the development of a special methacrylate terpolymer for air-drying and forced-drying automotive finishes. It was shown that the molecular weight of the resin must be controlled to combine good mechanical properties with ease of spraying ; the presence of carboxyl groups in the terpolymer improved pigment dispersion and gloss, while copolymerisation with higher alkyl methacrylates conferred internal plasticisation ; the new terpolymer had good petrol resistance and was compatible with polymethyl methacrylate and nitrocellulose.

Floor maintenance products : synthetic resin emulsions are finding increasing use in the manufacture of floor maintenance products : they are used as principal film formers in high resin content emulsion polishes and to modify self-gloss wax emulsion polishes. Two new Vinamul emulsions, based on modified methacrylate and styrene copolymers, are shown for the first time ; details are given of the effect of blending the synthetic resins with natural and synthetic waxes, thereby leading to polish formulations of good gloss, wearing properties and resistance to water spotting.

New products : the new products announced included a fine particle size, yet highly concentrated, polyvinyl acetate emulsion for the formulation of gloss paints ; an alkali-soluble internally plasticised terpolymer emulsion for leather finishing ; a non-volatile syrup of polyvinyl caprate which is suggested for use in metal casement putties, and an ethanol solution of a vinyl acetate-vinyl benzoate copolymer which has been found of interest for the manufacture of printing inks, paper varnishes and wire lacquers. Other new Vinalak solutions shown were internally plasticised vinyl acetate copolymers in ethanol, polyethoxyethyl methacrylate in isopropanol, and polystyrene in " Octaro."

Winkworth Machinery Ltd., 65, High Street, Staines, Middx.

THE mixers and blenders exhibited on this stand were intended for the laboratory rather than the production line. One item of interest was a change drum (or jar) tumbler. Consisting of a geared motor unit mounted on a base driving two transverse projection shafts each having a bracket to hold a ½-lb. jar, the design of this particular model has been based on the production-sized machine made by the company, who say that the tumbler has been found to have a wide variety of uses in the laboratory apart from dry colour mixing.

Also exhibited was a laboratory-sized ribbon-bladed powder blender, directly coupled to a geared motor unit mounted on a base. This particular model had a working capacity of 1 to 1½ lb. and could be easily dismantled for cleaning. Other twin-bladed mixers made to various constructional specifications and with interchangeable alternative blade arrangements were also shown. With the exception of the change-drum tumbler, all the equipment shown can be supplied in stainless steel, with or without jacketed troughs for steam heating or water cooling. Vacuum models are also available, and electrically-heated troughs can be supplied for operation up to high temperatures.

Victor Wolf Ltd., Victoria Works, Croft Street, Clayton, Manchester 11.

THE exhibits shown on this stand illustrated the outstandingly good colour and heat stability of the fatty acids produced by the company. Epoxy esters that were on view made from these acids demonstrated the pale colour that can be obtained. Examples of " Dimac," claimed to be the first dimeric acid bulk-produced outside the American continent and of considerably paler colour than the material hitherto available from that source on this side of the Atlantic, were also on view. Chemical figures of a typical sample of " Dimac " were given as follows : acid value 184 ; sap. value 194.7 ; iodine value (Kauffman) 94.5 ; unsap. matter 0.7 per cent ; viscosity (25°C.) 128 strokes ; colour 1¾ P.R.S. ; monomer 9.7, dimer 77.2 and trimer 12.4 per centages. As with the fatty acids, products of exceptionally pale colour can be made from " Dimac," and specimens of poly-amides made from the material were used to illustrate this.

New Thermo-Chemical Techniques

(*Continued from page* 195)

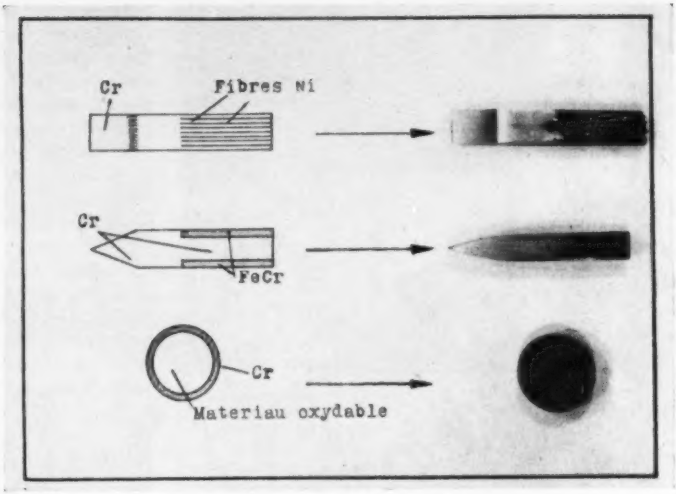


Fig. 18.—*Types of composite parts made from ductile chromium powder.* TOP *Chromium reinforced with nickel fibres (etched with hydrochloric acid).*

MIDDLE *Chromium with part sleeve in ferro-chrome (body of chromium powder and of sleeve of iron powder plus chromium powder sintered together).*

BOTTOM *Part of combustible material sheathed with ductile chromium.*

treatment of chromium powder can finally be used for purifying the metal which is utilized for preparing, by the usual methods, refractory alloys or certain light alloys.

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Unusual Tower Construction of Eletric Enamelling Furnace

(*Continued from page* 190)

head thermocouples are installed to work in conjunction with the controllers and recorder, one single thermocouple is available to give a record of any part of the furnace, the one on this furnace being inserted through the centre of the furnace roof. Three extra locations for this single couple are provided at each end of the furnace, so that a check can be made at each end at three different heights if required.

The furnace runs at a very high rate of efficiency, having a capacity of 800 lb. of ware per hour when firing large trough reflectors and over 1,000 lb. per hour when firing cooker parts and large sinks. The power consumption varies with production throughput, but for the figures quoted it averages at 75 to 80 kWh.

The effective inside working clearances of the furnace are 8 ft. long x 10 ft. 10 in. high and 2 ft. wide.

Such a furnace also lends itself to the firing of large architectural panels.

Developments in Barrel Polishing

(*Continued from page* 196)

and the control panel includes a time switch which can be set either to switch the machine off or on after a given number of hours.

At the end of a process the washing of the chips and parts in the barrel is carried out by the fitting of the wash-out door, clean water being injected through the special universal hose coupling in the centre of the door. The water hose to which this coupling is attached is usually suspended from above, adjacent to the barrel, and when water is required, all that is necessary is for the coupling to be slipped over the socket in the barrel door, which automatically allows the flow to commence. While flushing, the barrel is turning to ensure that the work mass is well washed. When the work mass is clean the barrel, still turning, is emptied by gradual tilting.

The operator frequently finds it convenient to remove ferrous parts from the barrel by using a strong hand magnet. The magnet is simply dipped into the mass of chips and parts while the barrel is turning. By this means the parts can be completely unloaded from the barrel without the removal of the chips.

FINISHING NEWS REVIEW

SCI's AGM SUGGESTS FOREIGN LINK-UP

THE annual general meeting of the Society of Chemical Industry's Corrosion Group was held on May 6 under the chairmanship of Dr. S. G. Clarke, D.Sc , F.I.M., A.R.I.C., at 14 Belgrave Square, London, S.W.1. His address given during the evening had the title " Corrosion as a design problem."

In the field of international relations, the committee has recommended to the parent Society that a proposal should be put to the International Union of Pure and Applied Chemistry (I.U.P.A.C.) that a corrosion division of the applied chemistry section of the Union should be formed.

Swenson pact for Incandescent Heat

FOR some years, the Incandescent Heat Co. Ltd., Smethwick, Staffs, have manufactured process equipment to the designs of the Swenson Evaporator Co., (a division of the Whiting Corpn.), of Harvey, Illinois, U.S.A. An agreement has now been reached giving Incandescent exclusive selling and manufacturing rights in the U.K. for all Swenson products. To handle this work, a chemical plant division has been formed, headed by Mr. C. J. V. Denning.

Lecture subjects in handling problems

MATERIALS handling problems arise in every industry, but a solution can often be found if an informed approach is made to the subject. The National Joint Committee on Materials Handling, representing more than twenty professional and kindred societies concerned with various aspects of handling, thinks it can help secretaries drawing up programmes for the 1959-60 sessions by suggesting suitable subjects for lectures and possible lecturers. Further information can be obtained from the Secretary at 69 Cannon Street, London, E.C.4. Telephone: City 4444.

Supply exceeds demand for aluminium

Annual Report of Aluminium Ltd. Outlines of Rogerstone Development

CONDITIONS of oversupply and strenuous competition affected the free world aluminium industry with " increased intensity " in 1958, Aluminium Ltd. states in its annual report issued recently. Net income is shown for the year as equal to 74 cents per share, compared with $1.37 per share in 1957.

The report states that the decline in earnings is attributable to " a combination of several factors including higher depreciation and interest charges, lower prices, reduced volume of metal sales and losses on the company's shipping operations."

The financial results of Aluminium Company of Canada Ltd. announced at the same time, also showed a drop in earnings. Alcan's accounts are in turn consolidated in those of its parent company.

Commenting to shareholders, Mr. Nathanael V. Davis, president, stated: " Total smelting capacity in the free world increased from about 3,600,000 tons as the year opened to 4,100,000 tons at its end, and some additional facilities are scheduled for completion in the next year or two. It seems likely therefore that even with a resumption of recent consumption growth rates, the producing industry must look forward to a condition of oversupply for the next few years until a further rise in demand restores the balance.

Implementing sales organization

"The present situation, which is not unlike that experienced by the industry after World War II, offers both a challenge and an opportunity to set in motion another forward surge in the demand for aluminium. Today, with the renewed availability of the metal and with more favourable price relationships to many competing materials, there are sound reasons to support the conviction that the stage is set for the entry of aluminium into mass consumption markets in many areas of the world. To accelerate this development the company is enlarging and strengthening its sales organization over a wide geographical area. Research and sales development efforts are being directed towards improving and diversifying the techniques for the fabrication and utilization of aluminium.

The economic progress felt in many areas late in 1958 is an encouraging indication that the western world is moving to a higher level of international trade activity. Having provided the essential power and raw material facilities to support production of 1,000,000 tons of primary aluminium in Canada, as compared with a current rate of 530,000 tons, the company should be in an excellent position to meet and benefit from future increases in demand."

Aluminium fabricating

Although the company's total sales of aluminium in all forms declined in 1958 in comparison with 1957, demand for its semi-fabricated products held strong in most markets throughout the year. In certain major markets, notably in Western Europe, sales were off in the early months but there was an encouraging upturn in demand in the closing months of 1958.

In the United Kingdom, a major expansion is being undertaken by Northern Aluminium Co. Ltd., to increase the capacity of its rolling mills at Rogerstone, Mon., from 50,000 to 75,000 tons of sheet products per annum, with provision for another 100,000 tons when required. The principal plant additions will include a 12-ft. wide hot mill for producing large aluminium plate required to develop new aluminium markets in shipbuilding, and land and air transport. Total new investment in the Rogerstone programme in 1958 to 1961 will be about $26 million, of which Aluminium Ltd. will subscribe one-third as equity.

Other fabricating facilities completed in Canada in 1958 included a rod and cable mill of 13,000 tons annual capacity at Vancouver, B.C. and a new 62-in. foil mill and new extrusion press at Kingston, Ontario. Other fabricating expansion is under way or completed in Australia, Brazil, France, India, Japan, Mexico, Spain and Switzerland.

Share earnings down—production cut back for first time in decade

International Nickel Report Tells of Easier Supply

NET earnings of The International Nickel Co. of Canada Ltd. and subsidiaries for 1958 were equal to $2.71 per common share, according to the annual report issued to shareholders by Mr. John F. Thompson, chairman of the board, and Mr. Henry S. Wingate, president. This compared with net earnings of $5.90 per share in 1957.

The drop in 1958 earnings reflected the lower demand for nickel, sharply reduced prices and deliveries of platinum metals, lower prices for copper, and a strike against the company which stopped all production at the mines and plants in Ontario during the final three months of the year. The statement says that in addition to the direct costs involved, the strike prevented the company from producing substantial quantities of copper, cobalt, iron ore and other readily saleable products. Deliveries of nickel, unaffected by the strike because of unsold stocks previously accumulated, were 84 million pounds less than in 1957. Deliveries and prices of platinum and palladium were down substantially, while the average price of copper in world markets was about 3½ cents per pound lower than in 1957. The strike settlement resulted in a long-term labour contract that should provide economic and more stable operating conditions for the years ahead.

Sharp Fall in Demand

The report goes on to say that in contrast with the experience of recent years, the demand for nickel in 1958 declined so severely in the United States, the principal market, that the company during the first half of the year was forced to make three successive curtailments in its rate of production in Canada, so that 1958 was the first year in almost a decade in which International Nickel did not operate at capacity. Nevertheless the company continued its new nickel mining project in northern Manitoba, development of which was ahead of schedule. The prompt completion of this project will be of great importance to the company, since prospective users of nickel, who have experienced many years of nickel shortage, must be given assurance not only that supplies will be plentiful in the future, but that the industry's production capacity will be large enough to handle surges in demand.

By mid-February of this year, according to the report there were definite indications of an upturn in nickel demand, and the outlook for increased sales was more encouraging than at any time since the reversal of the supply-demand situation just over a year ago.

Manitoba Project

A work force of up to 2,000 men was engaged during the year in developing the project at Thompson, Manitoba, scheduled to start smelter output in July, 1960, and to come into regular full-scale production at an annual rate of 75,000,000 pounds in 1961.

Sinking of the 2,100-ft. mine production shaft and of the 1,057-ft. development shaft was completed, and construction of surface facilities at the plant proceeded somewhat ahead of schedule. The production shaft head-frame was readied for installation of the permanent hoists and the 500-ft. stack to disperse waste gases and to supply draught to the smelting equipment was finished. The townsite situated astride the Burntwood River, two miles from the plant area, began to be transformed into the town of Thompson, which has been planned for an initial population of 8,000. Arrangements were completed in early summer for the construction of 200 dwellings in the town, of which 60 are occupied.

Exploration

Exploration expenditures in 1958 amounted to £7,396,000, compared with £8,948,000 in 1957. In both years about one-half of these expenditures was for exploration work in Manitoba. The systematic investigation of extensions of ore zones in the Sudbury district was continued, and the exploration of ore possibilities was conducted in northern Ontario,

Progress at the mining project in northern Manitoba is shown in the above photograph. In the left foreground is the steel work for the smelter. Between it and the 500-ft. stack are foundations for furnaces and convertors. Immediately beyond the smelter is the compressor building, and then the mill, of which the mine production shaft headframe is an integral part. In the distance can be seen Thompson Lake.

Saskatchewan, the Northwest Territories, Alaska and in Australia. Property examinations were also made in Africa, the East Indies, Mexico and a number of South and Central American countries.

Outlook

" The outlook for increased nickel sales is more encouraging than at any time since the reversal of the supply-demand situation at the end of 1957," the report says. " By the middle of February, 1959, there were definite indications of an upturn in demand.

" The reversal in 1958 of the very long decline in copper prices and the upturn in the price of platinum which took place in February, 1959, are encouraging, but it is not possible to forecast either price trends or consumer demand for these metals. By 1961 free world nickel production capacity is expected to reach a rate of approximately 650,000,000 pounds per year, or more than 50 per cent above the peak consumption rate of 1957. This represents a challenge which we as a major producer must meet."

APPOINTED AGENTS

RECENTLY appointed sole northern agents of Metal Containers Ltd., 17 Waterloo Place, Pall Mall, London, S.W.1, to cover Lancashire, Yorkshire and Scotland, are Turner and Brown Ltd., Davenport Works, Davenport Street, Bolton.

Mond Nickel June Exhibition for Sheffield

A PRIVATE exhibition is being staged by the Mond Nickel Co. Ltd., the Cutlers Hall, Sheffield, from June 2-5, featuring the properties of nickel, nickel-containing materials, the platinum metals and " S.G. " iron.

In addition to being the largest nickel producers in the free world, the Inco-Mond Organisation produces many other materials, including almost half the free world's production of the platinum metals. The exhibition has therefore been designed to feature the range of company products and to illustrate the special properties which make them vital materials for many applications in modern industry.

The exhibition is divided into sections dealing with mechanical and physical properties, corrosion-resistance, electrodeposition, strength at high temperatures, toughness at subzero temperatures, and welding. These main sections are further subdivided and include demonstrations as well as specimens of materials.

Each day a number of technical films will be shown relating to various aspects of the exhibition, including films on "S.G." iron, nickel alloy, permanent magnets, welding, corrosion, etc. A wide range of technical publications will also be available.

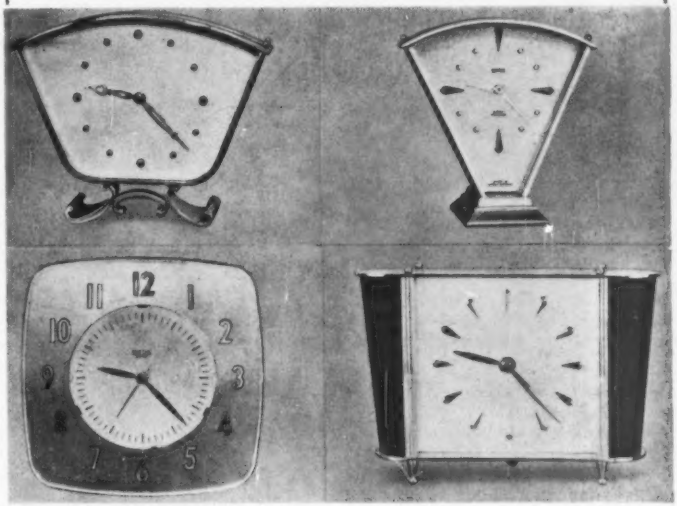
CIBA AWARD WINNERS NAMED

THE first fellowships to be awarded by the CIBA Fellowship Trust have been announced recently.

They are : Dr. M. H. Richmond (Cambridge University and the Medical Research Council) to study at Copenhagen University (microbiology); Mr. V. P. Arya (Banaras University and London University) to study at the Polytechnic, Zurich (natural products chemistry); Mr. J. F. Counsell (Bristol University) to study at Gottingen University (physics); Mr. G. L. Duncan (Aberdeen University) to study at Louvain University (polymer chemistry); Mr. K. Jones (Sheffield University) to study at Heidelberg University (organic chemistry); and Mr. B. L. Mordike (Birmingham University and Cambridge University) to study at the Max Planck Institute, Stuttgart (physical metallurgy).

Details of the inauguration of the Trust were given in the February issue of this journal.

Clock Cases in " Stelvetite "



Seen in the photograph above are four models in a new range of clocks being produced by Smiths Clocks and Watches Ltd. that uses Stelvetite plastic-coated steel sheet for the cases. A black and white seal embossed version of John Summers' product has been chosen for the line comprising six different timepieces. A Hainault firm, Elpeck Industries Ltd., are making the cases for Smiths.

PRE-PAINTED ALUMINIUM SHEET FOR CARAVANS

A LEADING manufacturer of " mobile homes " in Bonham, Texas, U.S.A., is to use pre-painted aluminium exclusively for the exterior skin. Mr. R. D. Franks, general manager of the company, Supreme-Victor Mobile Homes, said recently that his firm is switching from steel to Reynolds " Colorweld " sheet because it will provide aluminium with a paint finish at a cost comparable to steel painted in their own shop.

Although many caravans in the U.S. have aluminium walls and roofs, the use of pre-finished aluminium is a new trend. Produced by the Reynolds Metals Co., of Richmond, Virginia, in a wide range of stoved enamel colours, " Colorweld " sheet is delivered to manufacturers in coil or sheet form. It is claimed that the finish takes normal bending, will not peel or chip, requires minimum maintenance, and resists weathering under all climatic conditions.

Mr. Franks thinks that by using the material, his company will be able to instal an extra assembly line in place of the painting operation to not only increase production but to also eliminate any fire hazard that could arise from application and drying of paint in the plant. " Colorweld " can be furnished with opposite sides painted in matching or contrasting colours, enabling attractive combinations to be achieved, simply by reversing sheets. The maximum width of 36 in. now available is to be increased to 60 in. in the near future.

The Supreme-Victor factory at Bonham is one of the largest of its kind in the Southwest United States. From the 100,000 sq. ft. plant comes a wide variety of sizes and models for a mobile-home public now estimated to exceed three million. Sizes range from huge, 55-ft. long, 10-ft. wide models to a 15-ft. camping trailer. The company is generally regarded as being forward in adopting new production methods. Electronic glue-bonding of floors, electric welding of foundations, and installation of facilities usually associated with conventional homes are standard equipment on their products.

Diamond wheel companies merge product research

THE diamond manufacturing interests of Impregnated Diamond Products Ltd., Gloucester, and of Universal Grinding Wheel Co. Ltd., Stafford, are being concentrated at Gloucester as a result of the purchase by Universal Grinding Wheel Co. Ltd., from The Bath and Portland Stone Firms Ltd., of a 50 per cent holding in Impregnated Diamond Products Ltd. The product will in future be sold in the U.K. under the trade name "Uni-Neven" by Universal Grinding Wheel Co. Ltd., in addition to the fields already covered by Wickman Ltd., of Coventry. They will be supported by an engineering sales force provided by Impregnated Diamond Products Ltd.

The result of the merger will be to extend the range of production of Impregnated Diamond Products Ltd., to include all types of bonded diamond tools, and of graded micro diamond powders.

A research laboratory will shortly be completed at Gloucester where the combined research and development will be concentrated.

SUCCESS OF RAILWAYS "TOTE" SYSTEM

SINCE British Railways (London Midland Region) introduced in November, 1957, the "Tote" system for such commodities as powders, oils, paints, flour and sugar the demand has increased considerably. One firm which began with 50 bins for carbon black now hires 500. Traders dealing with china clay, activated carbon and impregnated pitch are other enthusiastic users.

The railway hires tote bins to traders at a very reasonable annual hire charge, thus relieving them of capital outlay on sacks. The trader can also stencil his name on the bins for advertising purposes. There is free return of the empties to the loading points.

Advantages of the system to the trader include bulk-purchase discounts, no bag or sack handling and no wastage through spillage. The railways gain by ease of handling, reduced handling, improved discharge time and the use of ordinary open wagons instead of special tank and hopper vehicles.

DUST CONTROL CONFERENCE BY HYGIENE SOCIETY

THE British Occupational Hygiene Society's tenth conference was held on April 14 and 15 in Stephenson Hall, University of Sheffield. The conference, devoted to a discussion of the control of dust and fume in industry, was opened by H.M. Chief Inspector of Factories. Papers were presented by speakers with experience of the subject in the cotton and asbestos industries, in iron foundries, in welding and electro-plating. During the conference, delegates paid a visit to Steel, Peech and Tozer's steelworks.

Copperbelt welfare schemes to go?

THE Copperbelt mining companies of Northern Rhodesia are considering shedding certain non-mining responsibilities to concentrate on mineral production. Stating this, a message from Barclays Bank D.C.O. local head office says that various plans have been made for certain housing areas to be taken over by civil townships or to be sold to employees. Discussions have also been held with the Rhodesian Federal Government concerning the status of mine hospitals and health services in general.

Rocol move

THE London office of Rocol Ltd., manufacturers of a wide range of molybdenum disulphide and other specialized lubricants for industry, is now at General Buildings, Aldwych, London, W.C.2. Telephone: Holborn 1985.

U.S. Lead Industries A.G.M. in Chicago

THE 31st annual meeting of the Lead Industries Association was held on April 22 and 23, at the Drake Hotel, Chicago, Illnois, U.S.A., with Mr. Robert L. Ziegfeld as secretary-treasurer of the organization.

Business sessions included papers evaluating current and new uses for lead, reports of Association activities, the annual business meeting and the election of directors. As in the past, a joint meeting with the American Zinc Institute was held to discuss their mutual expanded research programme.

PRICES OF FLUON DOWN

PRICES of "Fluon" polytetrafluoroethylene have been reduced by the makers, Imperial Chemical Industries Ltd. The average cost of "Fluon" granular polymer since March, 1956 has been about £5 a lb. The new prices represent, in general, reductions of 13 per cent. The material was first sold at around £4 a lb. in 1948. Increased output has made possible price reductions to the present level, the company says.

An ability to withstand chemical attack and its good insulating qualities have made "Fluon" an attractive material for the chemical and electrical industries, while other applications have developed from its remarkable "non-stick" properties. It has what is believed to be a wider working temperature range than any other plastics material. The "Fluon" range now includes granular polymer for moulding and extrusion, coagulated dispersion polymer for extrusion, and dispersions for a wide variety of applications.

FIRTH GROUP'S NEW CANADA OFFICE

THE address of the new Firth Cleveland Group Canadian office is: Firth Cleveland Ltd. (Canadian Office) 94 Laird Drive, Toronto, 17, Canada. Telephone: Hudson 3-2775.

U.S. company's prepainted windows

A STEEL window for general use that it is claimed will not require repainting for many years of continuous outdoor exposure is being marketed by the Truscon Steel Division of the Republic Steel Corpn., Youngstown, Ohio, U.S.A.

The development is founded on a new two-coat paint process that seals the Bonderized carbon steel or zinc surface against attacking elements by an epoxy-resin base coat and a smooth, hard, glossy finish coat of stoved enamel, modified for exterior exposure. Similar paints, the company points out, have been developed for use in the chemical and oil industries for maintenance purposes where acid resistance and weathering are important requirements. They say that extensive field and laboratory tests for adhesion, salt spray, humidity, water resistance and exterior durability have given exceptional results.

Left : Sir Owen Wansbrough-Jones makes his address at the opening of the Corrosion Exhibition. Above : The entrance to the Qutb Minar, with the famous Iron Pillar before it.

Sir Owen Wansbrough-Jones opens the Corrosion Exhibition

THE Corrosion Exhibition held last month at the Royal Horticultural Society's New Hall, Westminster, London, was officially opened by Sir Owen Wansbrough-Jones, K.B.E., C.B., chief scientist at the Ministry of Supply.

In his opening address, Sir Owen referred to the value of such exhibitions in providing a shop window for new wares, products and processes, for people who are often unconscious of their needs. He said he would like to make three points about corrosion: one perhaps antiquarian, the second economic, and the third more speculatively philosophical.

Referring to the first, he said that a few days before he prepared his speech he was in India close to the Qutb Minar, where there is an iron column of unrusting and uncorroded iron, made by Hindu metallurgists of the 4th century A.D. Study of this unique monument using chromium tracer techniques was about to be made. He remarked what a pity it was that so many works of art had been lost or marred through corrosive action, and he believed that there was real value in corrosion technologists applying some of their thoughts to making their finishes aesthetically satisfying as well as practically valuable.

On the economic side, he spoke of the enormous cost of corrosion in these islands where there was a moist climate and a good deal of atmospheric pollution. He was of the opinion that the figures commonly quoted were a little wide of the mark since they took no account of natural obsolescence, and he thought that the real damage was caused by losses in reliability, extra maintenance costs, and extra wear. It was in these fields that the Ministry of Supply felt itself to be particularly vulnerable, and he said that it was perhaps this aspect of corrosion—the maintenance of reliability, in detail—that the scientist can next tackle best. One particular benefit that could be attained by the perfected use of anti-corrosive measures in London, for example, would be that underground utilities really were permanent, a tremendous advantage in maintaining traffic flow.

Making his last point, he observed that perhaps in an entirely non-corrosive world, even though it was unthinkable that such a world could ever be attained, it might be necessary to use some of the resources now devoted to preventing corrosion to exploit what one might call controllable corrosion, for which he could see the possibility of some calculated use in the far-off future. In the meantime, we could reduce the economic losses that corrosion costs us by three obvious consecutive means : first, by securing the increase in basic scientific knowledge that is required ; second by exploiting this knowledge so that the scientific results may become commercially applicable, and third to make known to all concerned and in the widest possible way this great variety of commercial applications.

* * *

And More About that Iron Pillar

The mystery surrounding the Iron Pillar outside the Qutb Minar mosque near Delhi, India, is a fascinating story in its own right. Although the mosque was built in 1193 by the Moguls to commemorate the capture of Delhi, the pillar is much older. It is a solid shaft of wrought iron more than 16 in. in dia. and 23 ft. in length, and its height above ground is 22 ft. Where it came from for certain is not known, but it is believed to have been brought to Delhi by the Moguls from Bihar where it had originally been erected in the fourth century as a monument to King Chandra who had conquered Bengal. Chippings of the pillar were sent for analysis to Sir Robert Hadfield, F.R.S., who reported that the material was wrought iron of 99.72 per cent purity, an interesting point being that manganese was entirely absent. James Fergusson, commenting on the column in his "History of Indian and Eastern Architecture" remarks that Hindus at that age were capable of forging a bar of iron larger than any that had been forged in Europe up to a very late date.

Technical & Industrial Appointments

RUDOLPH HAHN
Aluminium Development

F. W. NICHOLLS
Firth Co.

E. L. ASHLEY
Northern Aluminium.

ROBERT D. HAMER
Aluminium Ltd.

Mr. L. C. Willsmer has joined the board of directors of Runnymede Dispersions Ltd., a subsidiary company of **Paripan Ltd.,** Egham, Surrey. Mr. Willsmer originally joined Paripan as export manager at the end of last year.

Mr. A. S. Halls has joined the sales staff of another subsidiary, Safety Cleaning Solvents Ltd., recently formed to market and to blend under licence the range of American products produced under the trade name "Penetone."

Mr. C. W. Grievson, has joined the staff of the marine division of Paripan, and Brigadier R. A. D. Mosley has recently joined the sales force of the company's architectural section in Central London.

* * *

Mr. E. W. Nicholls, of the **Firth Co. Ltd.,** has been appointed manager of the Group's Canadian office (see News, page 208) and has already left for Canada.

The following group companies will eventually be housed at the office: The Firth Company Ltd., Richard Hill Ltd. and Richard Hill Rolling Mills Ltd., Firth Cleveland Steel Strip Ltd., Keeton, Sons & Co. Ltd., Sheffield Wire Rope Co. Ltd.

* * *

The annual general meeting of the **Aluminium Development Association** was held on April 17 when the annual report was presented by the retiring president, Mr. S. E. Clotworthy.

Mr. Rudolf Hahn was elected president of the association for the ensuing period of 1959/60. On the A.D.A. council, Mr. Hahn represents the Association of Light Alloy Refiners and Smelters Ltd. He is a native of Berlin where, in 1921, he joined the family tube works, and was mainly engaged in the steel industry until 1938, when he decided to leave Germany with his family to make his home in England. Mr. Hahn then joined the newly formed company of B.K.L. Alloys Ltd., manufacturers of aluminium alloy ingots, of which he is now chairman and managing director.

Mr. S. E. Clotworthy (managing director, Northern Aluminium Co. Ltd.) was elected vice-president of the Association.

* * *

Mr. A. Biddulph has been elected chairman of the Midland section of the **Institute of Vitreous Enamellers.** His election follows a recent meeting of the new section committee comprising Mr. Darrall Baldwin, Mr. A. Biddulph, Mr. W. A. Ball, Mr. K. Phipps and Mr. G. Legg.

* * *

Changes have been announced in the board of **Avo Ltd.,** a company that recently became a member of the £11-million Metal Industries Group.

Joining the board are Sir Charles Westlake, chairman of Metal Industries, Mr. John Black, a director of Metal Industries, and Mr. H. O. Houchen, managing director of Brookhirst Igranic Ltd., M.I.'s electrical control gear subsidiary. They replace Mrs. E. Rawlings, Mrs. M. Brook and Mrs. I. E. Widdows, who have resigned.

Sir Charles becomes chairman of the board, with Mr. J. H. Rawlings, Avo's managing director, as deputy chairman. The other directors, who are unchanged, are Mr. F. H. Padfield, Mr. H. S. Macadie and Mr. S. R. Wilkins. Mr. Rawlings is to be appointed shortly to the board of Brookhirst Igranic Ltd.

Westinghouse Brake and Signal Co. Ltd., 82, York Way, London, N.1., announce that Mr. George William Dunkley, O.B.E., has been appointed a director of the company.

* * *

Mr. Robert D. Hamer has been appointed chief executive officer for **Aluminium Ltd.'s** international sales in Europe, Middle East and North Africa, with headquarters in Zurich.

Mr. Hamer was formerly vice-president of Aluminium Laboratories Ltd. in charge of the Banbury research laboratory and the company's Geneva office.

A graduate of the University of Saskatchewan in chemical engineering and of Charlottenburger Technische Hochschule, Germany, Mr. Hamer has served Aluminium Ltd. for 23 years.

Mr. Hamer is a Fellow of the Institute of Metallurgists, and the Royal Institute of Chemistry, a vice-president of the Institute of Metals, and a former president of the Aluminium Development Association in Britain.

* * *

It is announced by **Northern Aluminium Co. Ltd.** that Mr. E. L. Ashley, manager of the Banbury Works for over 25 years has been appointed a director of the company. It is also announced that the board has accepted the resignation of Mr. Kenneth Hall, assistant director of operations of the parent company Aluminium Ltd., Montreal, and a director of Northern Aluminium Co. Ltd. since 1946. Joining the organization in 1927, Mr. Ashley worked in Britain and Canada before moving to Banbury as sheet mill manager. He was

(*Continued in page* 211)

Technical and Industrial Appointments

(*Continued from previous page*)

later appointed works manager and in the following years directed the expansion of the plant.

* * *

The appointment of Allan Ray Putnam as managing director of the **American Society for Metals** is announced.

As managing director of the Society, Mr. Putnam will occupy a new position established by the ASM Board of Trustees following the death of William H. Eisenman, who was a founder-member of the Society and national secretary and executive head for 40 years.

* * *

The **British Compressed Air Society,** 32, Victoria Street, London, S.W.1 Council for the year 1959/60 is as follows :

Ordinary Council Members; Aerostyle Ltd., Atlas Copco (G.B.) Ltd., The Climax Rock Drill and Engineering Works Ltd., Compressor Accessories Ltd., The Consolidated Pneumatic Tool Co. Ltd., Hymatic Engineering Co. Ltd., Padley and Venables Ltd., Reavell and Co. Ltd.

Associate Council Members; Fullerton, Hodgart and Barclay Ltd., C. A. Norgren Ltd.

At the first meeting of the new Council the following appointments were made : president: Mr. E. A. Martin (Padley and Venables Ltd.); vice-president: Mr. J. C. Greig (Atlas Copco (G.B.) Ltd.); hon. technical director: Mr. T. C. Hore (Holman Bros. Ltd.); hon. publicity officer: Mr. H. S. Parsons (The Consolidated Pneumatic Tool Co. Ltd.).

* * *

Mr. Verdon O. Cutts, manager of the process heating department of **The General Electric Co. Ltd.** has retired. He joined the G.E.C. in 1929 and built up the process heating department covering electric furnaces, high-frequency heating and infra-red heating.

Mr. Cutts is a Fellow of the Institute of Metallurgists, a member of the Institute of Metals, and other technical Institutes and Societies. In 1953 he was president of the electric furnace section of the International Congress on Electro-Heat held in Paris.

Mr. Cutts will resume his consulting practice from his home address : 1, Ramsay Lodge, Hillside Road, St. Albans.

* * *

Martonair Ltd., manufacturers of pneumatic equipment, have ceased to be represented in the north-west by R. G. Smith (Accrington) Ltd., and have appointed two new technical representatives in this area : Mr. G. Parfett—Liverpool, Chester, Preston and Mr. C. F. Holding—Leeds, Bradford, Wakefield, who will operate from a new office in Manchester. A third representative will be appointed shortly.

* * *

Mr. William H. McFadzean has been elected president of the **Federation of British Industries** for the coming year. He succeeds Sir Hugh Beaver who has retired after holding office for two years.

Mr. McFadzean has been chairman and managing director of British Insulated Callender's Cables Ltd. since 1954.

* * *

Mr. Norman Burgess has left the Aluminium Development Association to join the research and development department of the **Central Electricity Generating Board** in London. His work will be connected with the weldability of materials used in steam power plant, and with non-destructive testing. Before joining the A.D.A. four years ago, he had been with the British Aluminium Co. Ltd.

* * *

The following new agents and technical representatives have been appointed by **Baldwin Instrument Co. Ltd.**—

Scotland—

Sales and service and technical representation : James Scott and Co. Ltd., 68, Brockville Street, Carntyne Industrial Estate, Glasgow, E.2. Tel.: Shettleston 4206-9.

North of England—

Sales and service : Wm. Don and Partners Ltd., Crown Works, Crown Point Bridge, Leeds, 9. Tel.: Leeds 33781-2.

Technical representative : Mr. J. D. Thornley, Waterhey Cottage, Rivington, Nr. Bolton, Lancs. Tel.: Horwich 364.

Midlands—

Technical representative : Mr. P. Lawrence, 16, Hawthorn Road, Kings Norton, Birmingham, 30. Tel. : Kings Norton 4476.

The home counties, Wales, and west country will still be covered by the technical staff based at Dartford.

Mech. Handling Exhib.

THE next Mechanical Handling Exhibition, and Materials Handling Convention, occupying over half-a-million sq. ft. of space will be held at Earls Court, London, from May 3-13, next year.

Galvanized "Dexion" to be shown at exhibition

GALVANISED "Dexion" slotted angle will be shown for the first time at Dexion's own exhibition to be held at Stonebridge Park, Wembley, from May 26 to June 4.

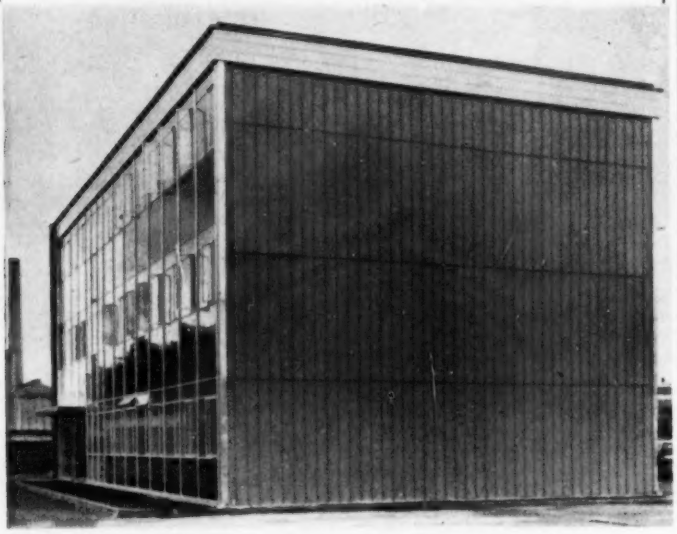
Galvanised Dexion with a 0.003 in. coating has been developed specially for outdoor structures or for use in atmospheres where normal metal is subject to corrosion. It will be available in all the standard Dexion sizes except 112. The company say that extensive tests have been carried out at their research and development department, using salt sprays and humidity cabinets.

Also on view for the first time will be Dexion's new multi-purpose grid, Tecon engineered timber products, and the Dexion low cost building scheme for overseas. The Tecon products have been designed to simplify the construction and reduce costs of all types of roofs. Multi-purpose grid can be used for the quick and easy assembly of anything from work platforms and car ramps to mobile platforms and trolleys. It will be shown at the exhibition as part of a launching campaign.

New headboard in stainless steel for crack express

LAST month at a ceremony in the Sheffield works of Firth Stainless Steels Ltd., Mr. W. D. Pugh, chairman of the company presented to the Master Cutler, Mr. J. Hugh Neill, a new headboard for British Railway's crack express that runs between London and Sheffield. The train is named the "Master Cutler," and the headboard cast in "Staybrite" stainless steel bears this legend as well as the coats of arms of the city of Sheffield and the Company of Cutlers in Hallamshire. Reason for the ceremony was that the express was re-routed last year to run from King's Cross instead of Marylebone, and because the train's steam locomotive was replaced by a new diesel traction unit, it was felt that a new headboard would also be appropriate. The one that graced the front of the train on the run to and from Marylebone for eleven years has been mounted on an oak stand and will occupy a place in the Cutler's Hall in Sheffield.

Factory Wall is Movable



STELVETITE WALL WILL BE RE-ERECTED

A TEMPORARY end-wall of "Stelvetite," the plastic-coated steel, erected last year at the office block of B.X. Plastics Ltd., Manningtree, Essex, will shortly be taken down and re-erected on the end of a new extension to the building. The material is produced by John Summers and Sons Ltd., the steel company of Shotton, Chester, in collaboration with B.X. Plastics. It combines the strength and rigidity of steel with the corrosion resistance and colour of plastic and is resistant to acids and alkalis, abrasion, weather and humidity.

For the wall, approximately 36 ft. long and 30 ft. high, grey corrugated Stelvetite was used with a texture finish. This was fixed to a timber framework, bolted to the main structure, and the exposed horizontal edges of the sheets were protected with a U-shaped plastic cover strip.

Chemical Engrs. Issue New Regulations

The latest (November 1958) edition of the "Regulations for the Admission of Student, Graduate, and Corporate Members, and for the Examination of the Institution," have recently been issued by the Institution of Chemical Engineers, 16, Belgrave Square, London, S.W.1.

The regulations now contain some guidance on "training and experience" requirements for associate membership; also of interest is the new syllabus for Paper D (Engineering drawing) of the Institution examination which is to come into force starting with the 1960 examination. The latter has been inserted in the regulations as a leaflet (with new membership subscription rates on the reverse).

The engineering drawing syllabus has been revised with a view to giving teachers and students more advice on the content of this part of the examination.

Insurance Rules in one document

SOME 15 sets of regulations dealing with the industrial diseases provisions of the Industrial Injuries Insurance scheme have been consolidated into one document in regulations made by Mr. John Boyd-Carpenter, Minister of Pensions and National Insurance. The consolidation in no way changes the effect of the regulations.

Trade and Technical Publications

Non-sacrificial lead alloy anodes for impressed current cathodization that have been approved by Lloyd's of London for the protection of ship hulls against corrosion are featured in an article in the latest issue of "Lead," quarterly publication of the Lead Industries Association, 60 East 42nd Street, New York 17, U.S.A. The results of actual sea trials on a Royal Canadian Navy destroyer, reported by the Naval Research Establishment, Nova Scotia, are given.

Another article in this issue describes the recent development of a lead alloy brazing material for low-cost production of high quality metal-to-ceramic seals claimed to be useful up to working temperatures of about 300 deg. C. The braze alloy is essentially a lead-copper alloy containing 3 per cent titanium, and can be used in either powder, sheet or wire form. Brazing temperatures range from 900 to 1,000 deg. C.

A final article describes the effective use of red lead paint on the world's largest passenger railroad, the New York City Transit System. In one example cited, a part of an elevated structure had not been repainted in over 50 years, yet the structure was found to be still sound due primarily to the original primer coats of red lead that had protected the steel for this long period of time.

* * *

The increasingly important role which powder metallurgy is assuming in many fields of industry is reflected in the proceedings of the first three symposia held by the Powder Metallurgy Joint Group of the Iron and Steel Institute and the Institute of Metals. Abstracts of the many papers of general or specific interest to nickel-containing materials form a feature of the March issue of The Nickel Bulletin, published by The Mond Nickel Co. Ltd., Thames House, Millbank, London, S.W.1.

The issue includes also reference to several papers on the properties of nickel-iron magnet materials, and among the abstracts on nickel plating are items concerned with the chemistry and determination of brightening additives, hard-nickel plating, distribution of nickel deposits, corrosion-resistance of plated coatings, and electroless plating.

The section concerned with heat- and corrosion-resisting materials contains reference to several important papers on creep-resistance, and on pitting corrosion.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Variable-ratio Resin Dispenser

A NEW variable-ratio resin dispenser for use with most two component liquid resin and hardener systems, has recently been introduced by the Delsen Corpn., 719, West Broadway, Glendale 4, Ca., U.S.A. A simple lever adjustment allows the ratio of resin to hardener to be varied over a wide range. Use of the dispenser will allow rapid changeover from one resin-hardener system to another. Changes in resin to hardener ratio can readily be made to compensate for changes in ambient temperature, and a reference scale is provided so that ratios can be accurately reset. Provision is made for locking to prevent unintentional changes. The dispenser is equipped with drip-proof outlet valves, and is available in both hand-operated and motor driven models.

Fig. 1.—A dispenser for use with most two-component resin and hardener systems.

Non-Standard Finishing Materials

IN the course of a wide range of development projects carried out for customers with particular finishing problems, Roto-Finish Ltd., Mark Road, Hemel Hempstead, Herts., say they have evolved a number of special processing media. The new materials are not intended to replace the standard products normally suitable for finishing work, but have been introduced for individual applications. Brief descriptions of some of these materials are given below, with some of the advantages the company claim for each :

"*Ceri-Forms*" *Type D.* A new triangular shaped ceramic bonded chip possessing 75 per cent speed with only half the rate of wear of the fastest aluminium oxide chip. Claimed to reduce the risk of lodgement in blind holes or recesses, the chip produces a very fine matt finish. Available in one size only, size dimensions are 1 in. x 1 in. x $\frac{3}{4}$ in. with a thickness of $\frac{1}{2}$ in.

Grinding Media. Available in a wide variety of shapes and sizes these metal media can be used with abrasive compounds for fast deburring, surface cut-down and the production of fine, matt finishes. Normally supplied for specific or unusual applications where the avoidance of chip lodgement is the most important requirement.

"*Colouring*" *Media.* For colouring or producing high surface lustres, alternatives to the standard steel ball can be provided. These comprise saturn-shaped polished steel media ; polished steel diagonals ; polished steel ovoids. "*Lustre-Pebs*"—cheaper than steel balls, but producing a surface lustre which is almost comparable. Supplied in two grades, A and B, each in sizes $\frac{1}{4}$ in. and $\frac{3}{8}$ in. These are sometimes used in preference to steel balls in order to avoid discolouration which, in certain rare cases, results from galvanic corrosion when steel balls are used in processing zinc alloy parts. Zinc balls—for colouring zinc alloy die castings. These produce finishes comparable to those previously obtained using steel balls and shapes, with the great advantage of completely eliminating galvanic corrosion.

Contact Adhesive Allows Positional Adjustment

A NEW contact or impact adhesive that gives an instantaneous bond on contact at right angles to the job, yet enables complete freedom of movement in a lateral plane, has been developed by Polybond Ltd., 16 Gloucester Place, London, W.1. The technique is claimed to overcome the difficulty of having to exactly position the parts to be joined prior to contact, necessary when using many impact adhesives. The company claims that their new product allows ample time for moving the workpieces in contact with each other without impairing adhesion.

No solvents are used with the process, and some of the advantages claimed for it are that it is free-running, clean to use, cleaning operations require only water, and the bond is far stronger than traditional contact resins. Among other applications, the material is suitable for fixing metal sheets to a wide variety of surfaces.

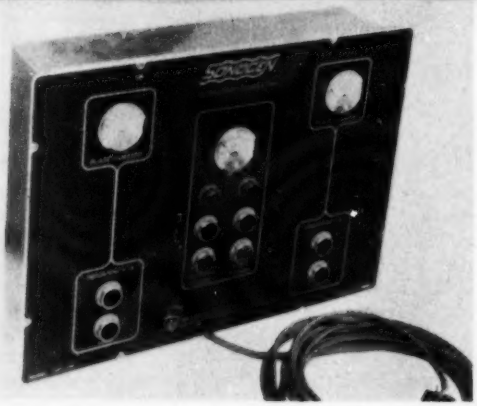
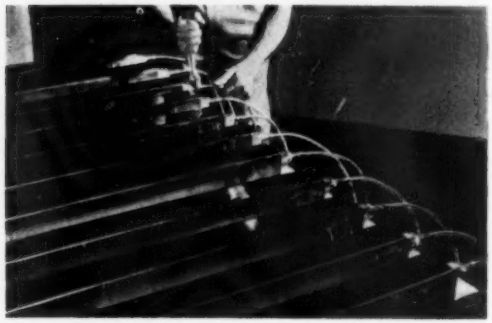


Fig. 2

The Model APT-500 Sonogen ultrasonic generator is designed for large-scale automatic cleaning operations. Because it can energize up to 6 sq. ft. of transducer area, it is ideal for conveyorization of equipment through long tanks. A separate instrument panel (inset) allows remote operation of the generator from a central control area.

Each transducer shown here, having a surface area of 75 sq. in., requires 250 W of high-frequency (38kc) energy. Up to twelve of these may be driven by a single Model APT-500 Sonogen ultrasonic generator.



Ultrasonic Generator is Remote Controlled

THE model "APT-500 Sonogen" generator, illustrated in Fig. 2, having a 3-kW average power output, is available from Branson Ultrasonic Corpn., Stamford, Conn., U.S.A. It is designed for continuous production cleaning, and will activate up to 6 sq. ft. of transducer area, or 300 gal. of cleaning solution. The unit features motor tuning, twin oscillator construction and, for the first time by this maker remote control that makes it ideal for many production cleaning set-ups, because the control panel can be incorporated with other instruments at a central point.

Both remote and local control panels include filament and plate power switches, a line voltage meter, and push buttons for motor tuning, to provide frequency adjustment between 36-40 kc. All control circuitry is at 110 V obtained from a step-down isolation transformer. There are also adjustable taps for voltages from 190-240 V (or 400-500 V in the 440-V model) at 60-cycle A.C., together with output impedance-matching circuits. Other features are a voltage stabilizing transformer in the filament circuit; plate voltage 25 per cent below recommended ratings; simple circuitry; and four heavy-duty air-cooled power triodes. Complete fusing is also provided.

The model "APT-500" powers conveyorized systems and other large, all-ultrasonic cleaning installations. It is also claimed to be an economical substitute for manual cleaning at the immersion stage of large-scale washing, degreasing, or plating installations. Twin oscillator construction allows the generator to activate two cleaning tanks independently, particularly useful for cleaning and rinsing, or for degreasing operations, where parts are often so heavily soiled that two stages are required.

Weighing 350 lb. the unit measures 30 in. x 24 in. x 72 in. high, and is constructed of $\frac{1}{8}$ in. aluminium to reduce eddy current losses. Removable panels, with safety interlocks, allow easy access for servicing. More information is available from the makers at 40, Brown House Road, Stamford, Conn., U.S.A.

Dry Chemical Feeder and Merchen Scale Feeder

THE problem of handling certain "hard-to-feed" materials such as zinc oxide and diatomaceous earth has led to the development by Wallace and Tiernan Ltd., Power Road, London, W.4., of a dry chemical feeder. Volumetric in principle, it will feed free flowing chemicals in powder or granular form, with controlled accuracy. Arching, clogging or flooding of the material is prevented by the feeding and hopper mechanism. Where solution mixing is required, either a swirly-type solution chamber with jets, or a 25-gallon tank with jet or optional mechanical mixer, can be incorporated. The feed rate is adjustable over a wide range by a simple control knob. A typical example is carbon at 0.25 to 25 lb. per hr.

The material to be fed is loaded into the top of a hopper with oscillating diaphragm-type agitators and a capacity of $3\frac{1}{4}$ cu. ft. The feed-screw combines rotary action with back-and-forth axial movement and discharges chemical alternately from either end of the screw into feed spouts. Construction is of heavy-gauge steel with corrosion-resistant finish. Further information is contained in a technical publication No. S/205, available on request. Another piece of equipment recently introduced by this company is the Merchen scale feeder illustrated in Fig. 3 for handling many types of dry, ground and free-flowing materials. The feeder is claimed to meet this need dependably and economically,

Its totally-enclosed construction makes it ideal for handling dangerous or easily contaminated commodities. Over any point of a 10 : 1 control range, the makers say the feeder has an accuracy rather better than plus or minus 1 per cent.

Material entering the feed section from above falls on to a supported weigh-belt, is carried under a flow-controlling gate and then over a section where the weigh belt is counter-balanced by a pre-set weight on a scale-beam. All the material fed is weighed, the continuous action of the gate being dependent on impulses from the weighing mechanism to increase or decrease the flow.

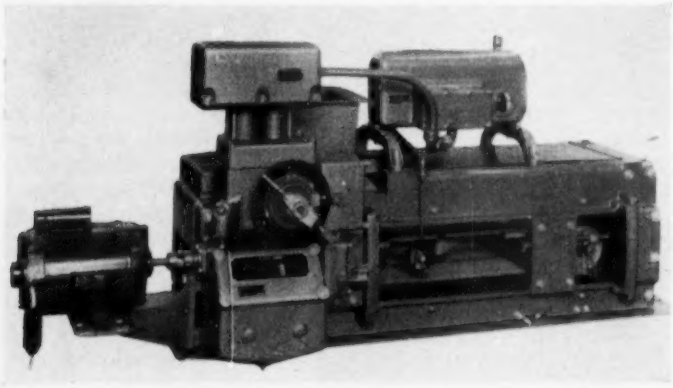
The Merchen feeder can be fitted with remote rate-of-feed control and arranged to meter chemicals in proportion to liquid flows or to suit any other continuous process. Its construction makes it suitable for industrial usage. Technical publication No. S/207 is available on request.

Concave Magnetic Conveyor Rolls

A NEW range of concave rolls to augment their standard range of magnetic roll equipment has been announced by Rapid Magnetic Machines Ltd., Lombard Street, Birmingham, 12 (Fig. 4). Concave rolls provide a means of conveying freshly galvanized pipe from the bath to a rack or mechanical conveyor. The operator simply hooks the pipe from the bath with tongs and places one end against the underside of the magnetic roll, which then automatically transfers the pipe, in a suspended position, from the bath to subsequent conveyor, without risk of damage from pipe wobble. The usual arrangement includes a series train of three to eight magnetic rolls, the pipe being conveyed at about 12 deg. inclination to allow for adequate drainage. Double rolls are also available. The pipe rolls are manufactured in two diameters, 15 in. for pipes up to 3 in. dia., and 18 in. for up to 6 in. dia. pipes.

Fig. 3.—(left) The Merchen feeder with a totally enclosed construction is ideal for feeding metered material in a continuous process.

Fig. 4.—(below) Magnetic concave rolls can carry galvanized pipe from bath to mechanical conveyor.



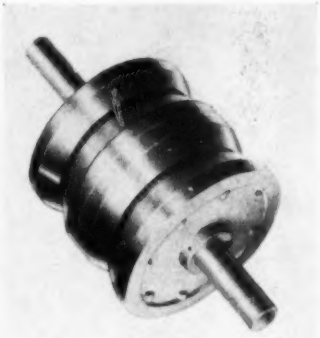


Fig. 5.—(Left) The three main components of the spraygun for use with the Ransburg No. 2 process, and (above) the gun in use.

Handgun for Electrostatic Paint Spraying

THE latest development of the Harper J. Ransburg Co. of Indianapolis, U.S.A., is their No. 2 process electrostatic handgun, now being manufactured in this country after a successful introduction in the U.S.A. The equipment is being marketed in the U.K. and on the Continent by Henry W. Peabody (Industrial) Ltd., 17 Great Suffolk Street, London, S.E.1.

The Ransburg No. 2 electrostatic spraying process has so far only been available in a mechanized form ; the electrostatic spray gun is claimed to eliminate overspray and the necessity for conventional spray booths. As can be seen from the illustration, (Fig. 5), the equipment consists of the handgun incorporating an atomising bell, rotator motor and paint feed trigger control. The gun is connected by a cable to a small transformer that provides the high voltage 90kV full-wave rectified current necessary for operation. Both gun and transformer incorporate safety devices to ensure that no current discharge can occur that could cause danger either in solvent-laden atmospheres or to personnel.

Developed in Ransburg's Indianapolis laboratories over a long period of time, the gun has been tested in factories in the United States for painting a large range of different products. On flat sheet work, the Ransburg handgun operates at a comparable rate to the conventional airspray gun, although it may be a little slower on large flat surfaces. But the makers say that for small articles, or for items made from perforated or expanded metals, and for tubes, rod and wire products, the speed of operation is very much greater than with normal handspray methods because of the "wrap-around" caused by the attraction of the electrostatic field. For this reason, handling of the work in the spraying zone is considerably eased since the number of different angles from which this type of part must be sprayed is greatly reduced. It is also claimed that a considerable saving in paint costs and in expenditure on providing various spray booth facilities can be made. Despite its comparatively large size, the gun is of light weight, and can be operated by relatively unskilled labour.

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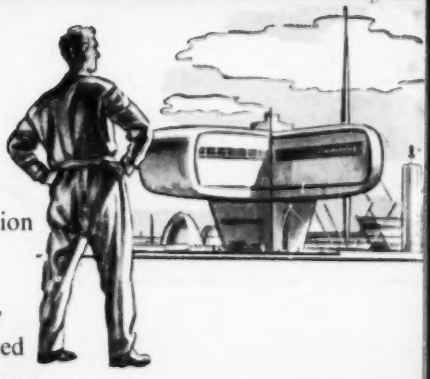

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